For the reader

Aalto University students may apply for a study right at another Aalto school. Students may apply for either an individual course or a minor.

This guide contains:

- a presentation of all those minors offered in accordance with the new degree structure by the School of Arts, Design and Architecture (ARTS)
- a presentation of all those minors offered in accordance with the new degree structure by the schools of technology (CHEM, ELEC, ENG, SCI)
- a presentation of minors at School of Business (BIZ) which are offered also to applicants from other Aalto schools
- a listing of individual courses for which the Aalto University schools offer places for students of other schools
- a listing of Aalto cross-school courses and University Wide Art Studies that are open to all students at the Aalto University, regardless of their field of study

The modules compliant with the old degree structure of the schools of technology (CHEM, ELEC, ENG, SCI) and the minors offered only to students of the School of Business have been presented in the study guides of the relevant schools.

Abbreviations explained:

ARTS = School of Arts, Design and Architecture
BIZ = School of Business
CHEM = School of Chemical Technology
ELEC = School of Electrical Engineering
ENG = School of Engineering
SCI = School of Science

Minors in Aalto University

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Some minors require an application, while others are open for all.

See the presentation of each minor for information on the target group and the application procedure.

Application periods

The general application procedure for minors at Aalto University is organised twice a year

- from 15 to 31 May and
- 15 to 30 September.

Please notice, that some of the minors only accept applications during one of the application periods of the academic year: only in autumn or in spring. See the presentation of each minor for information on the application procedure.

A granted study right will be valid at the beginning of the next semester. The granted study right does not guarantee the access for a specific course, in case the course is defined with e.g. a pre-exam, a quota for participants, or a priority order.

Some of the minors at Aalto University do not follow the application periods mentioned above

With these minors also the time when the granted study right will be valid might vary.

- *Aaltonaut*
- *Aalto Service Minor*
- *Aalto Ventures Program (AVP)*
- *Information Technology Programme (ITP)*
- *Minor in International Business (Mikkeli Campus)*
- *Multi-Disciplinary Energy Studies (MES)*

Applying

1. Familiarise yourself with the minor selection

Minor selection in the academic year 2016–2017

- School of Arts, Design and Architecture
- School of Business
- School of Chemical Technology
- School of Electrical Engineering
- School of Engineering
- School of Science

2. Get the minor approved as part of your Personal Study Plan

In your application, you must include your approved personal study plan (PSP) indicating that the minor applied for has been approved as part of your study plan. **Without an approved PSP, the application will be rejected at the receiving School.** PSP under the status of "primary" or "being approved" is not considered an approved PSP.

Granting a study right at the receiving School does not mean that the student can automatically include the studies as part of his/her degree. It is the responsibility of the student to make sure that

the minor can be included as part of of his/her degree by approving it in his/her Personal Study Plan (PSP) before applying for the study right.

Get the minor approved as part of your Personal Study Plan well in advance before applying!

If you're applying for a study right for numerous minors during the same application period, please update all of these minors in your Personal Study Plan in one way or another. For example, you can mark in the additional information of your minor: "or alternatively minor X, minor X, minor X or minor X".

3. Fill in the application

1. Go to the application form: *direct link to the application form is found here during the application period*
2. Log in by using your Aalto username and password.
3. Fill in the application. Please check particularly carefully that the details of the course/minor applied for are correct.
4. Remember to include your personal study plan (HOPS) and any other appendices required (on a separate tab).
5. Save the application.
6. Remember to send the application.
7. With one application, it is only possible to apply to one minor. If you want to apply a study right for numerous minors, you have to submit a separate application for each minor.

Decisions on study rights

You will receive the decision on your study right within about a month from the application deadline. If there are a lot of applications this might sometimes take longer. You can see the decision by logging in to eAge-system and opening the decision. If you were not granted a study right you can apply again during the following application periods if the course/minor is offered.

Principles of granting the study right

In case the minor has more applicants than the quota, the study right will be granted according to the following principles: the progress of the students studies at the home School (in general the student that are farther along in their studies are given priority), how the applicants fulfill the possible prerequisites. Students who have already started completing the minor (by completing courses that form a part of the requirements of the minor) will be prioritized when granting study rights for the minor in question. If it is not possible in any way to make the distinction between applicants, the student/s who will receive the study right will be drawn out of the hat.

Contact information

- School of Arts, Design and Architecture
- School of Business
- School of Chemical Technology
- School of Electrical Engineering

- School of Engineering
- School of Science

Taking elective courses at another Aalto school

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Taking elective courses at another Aalto school

Some of the courses at Aalto are open for all Aalto students

So called Aalto cross-school courses and University Wide Art Studies -courses are open for all Aalto students. They are specially suited for students from all backgrounds. You do not need to separately apply for a study right for these courses.

- Aalto cross-school courses
- University Wide Art Studies

Degree students at other Aalto Schools do not need to separately apply for a study right in order to complete courses at the School of Chemical Technology, School of Electrical Engineering, School of Engineering or School of Science.

- School of Chemical Technology
- School of Electrical Engineering
- School of Engineering
- School of Science

School of Arts, Design and Architecture and School of Business offer places on some of their courses for students from other Aalto Schools

Places are limited, and study right must be applied for. Study right can only be applied for courses that are listed as part of the offerings for students from other Aalto Schools.

- School of Arts, Design and Architecture
- School of Business

When to apply?

Individual courses are open for application (with some exceptions) four times a year as follows:

- May 15 - May 31 for courses in periods I–V (next academic year)
- Sep 15 - Sep 30 for courses in periods II-V
- Nov 15 - Nov 30 for courses in periods III-V
- Feb 1 - Feb 15 for courses in periods IV and V.

How to apply?

1. Familiarise yourself with the studies offered

Course selection in the academic year 2016–2017

- Aalto cross-school courses
- University Wide Art Studies
- School of Arts, Design and Architecture
- School of Business
- School of Chemical Technology
- School of Electrical Engineering
- School of Engineering
- School of Science

2. Familiarise yourself with preliminary requirements

The applicant must fulfill the possible preliminary requirements or other conditions for successful accomplishment set for a specific course. The applicant may simultaneously apply for a study right for the course granting the preliminary requirements and for the following course, and after gaining the study right, will take the courses in the required order.

3. Get the studies approved as part of your Personal Study Plan (PSP)

In your application, you must also include your personal study plan (PSP) indicating that studies applied for have been approved as part of your study plan.

Granting a study right at the receiving School does not mean that the student can automatically include the studies as part of his/her degree. It is the responsibility of the student to make sure that the studies can be included as part of of his/her degree by approving them in his/her Personal Study Plan (PSP) before applying for the study right.

Get the studies approved as part of your Personal Study Plan (PSP) well in advance before applying!

4. Fill in the application

1. Go to the application form: *direct link to the application form is found here during the application period.*
2. Log in by using your Aalto username and password.
3. Fill in the application. Please check particularly carefully that the details of the course applied for are correct.
4. Remember to include your personal study plan (PSP) and any other appendices required (on a separate tab).
5. Save the application.
6. Remember to send the application.
7. With one application, it is only possible to apply for one course. If you want to apply for a study right for numerous courses during the same application period, you have to submit a separate application for each course.

Decisions on study rights

You will receive the decision on your study right within about a month from the application deadline. If there are a lot of applications this might sometimes take longer. You can see the decision by logging in to eAge-system and opening the decision. If you were not granted a study right you can apply again during the application periods if the course/minor is offered.

Possible restrictions on attending the courses

The granted study right does not guarantee the access for a specific course, in case the course is defined with e.g. a pre-exam, a quota for participants, or a priority order.

Principles of granting the study right

In case the course has more applicants than the quota, the study right will be granted according to the following principles: the progress of the students studies at the home School (in general the student that are farther along in their studies are given priority), how the applicants fulfill the possible prerequisites. If it is not possible in any way to make the distinction between applicants, the student/s who will receive the study right will be drawn out of the hat.

Contact information

- School of Arts, Design and Architecture
- School of Business
- School of Chemical Technology
- School of Electrical Engineering
- School of Engineering
- School of Science

Aalto cross-school courses

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Aalto cross-school courses

An Aalto cross-school course is a course organized by one or more Aalto schools that is open to all students at the university, regardless of their field of study.

Registration for these courses is done mainly via WebOodi (you don't need to separately apply for a study right for these courses), where one can also find more information about the courses.

See also University Wide Art Studies

Degree students at other Aalto Schools do not need to separately apply for a study right in order to complete courses at the School of Chemical Technology, School of Electrical Engineering, School of Engineering or School of Science.

I

Kauppakorkeakoulu / Handelshögskolan / School of Business

21E16000 Sustainable Business and Consumption, 6 ECTS

23C77051 Myynnin verkkokurssi, 6 ECTS

25E19000 Entrepreneurial Competencies, 6 ECTS

31C00300 Suomen talous ja talouspolitiikka, 6 ECTS

31E11100 Microeconomics: Pricing, 6 ECTS

31E15000 Development Economics I, 6 ECTS

32C25000 Sopimusjuridiikka, 6 ECTS

32E2220 Elinkeinoverotus, 6 ECTS

32E11100 Legal Aspects of Finance, 6 ECTS

Taiteiden ja suunnittelu korkeakoulu / Högskolan för konst, design och arkitektur / School of Arts, Design and Architecture

MUO-E8021 Participatory Methods and Facilitation Skills, 5 ECTS

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

TU-E4040 Opportunity Prototyping, 3 ECTS

TU-E4000 Changemakers, 1 ECTS

Yhd-12.3081 State of the World and Development, 2 ECTS

ELEC-A8001 Johdatus sähköenergiajärjestelmiin, 3 ECTS

I-II

Kauppakorkeakoulu / Handelshögskolan / School of Business

21E72500 Finding Joy and Productivity in Academic Writing, 6 ECTS

21E16000 Sustainable Business and Consumption, 6 ECTS

21E72500 Finding Joy and Productivity in Academic Writing, 6 ECTS

23C60000 Market Research, 6 ECTS

25E50000 Venture ideation, 6 ECTS

26E04450 Design Business Management, 5 ECTS

31C00100 Mikrotaloustiede, 6 ECTS

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

CSE-E4751 Introduction to IT Business and Venturing, 2 ECTS

PHYS-C9381 Energialukutaito: ydinkysymyksiä ja -vastauksia energiasta, 3 ECTS

AAN-C2007 Product Sustainability, 5 ECTS

NBE-C3001 Aivoaakkoset, 4 ECTS

CHEM-A1600 Akateemisen ajattelun alkeiskurssi, 3 ECTS

Taiteiden ja suunnittelu korkeakoulu / Högskolan för konst, design och arkitektur / School of Arts, Design and Architecture

ELO-C3039 Animaatioilmaisun perusteet, 1-3 ECTS

ELO-C1502 Dokumentaarisen elokuvan teorian ja estetiikan perusteet, 2 ECTS

ELO-C4013 Elokuvauksen kirjatentti, 1 ECTS

ELO-E5012 Lavastustaiteen erityisalueet (MA): Storytelling in virtual reality, 5 ECTS

I + V

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

TU-E4110 Aalto Fellows, 5 + 5 ECTS

I - V

Kauppakorkeakoulu / Handelshögskolan / School of Business

21E00035 Management and Strategy Book Club I, 3 ECTS

21E00036 Management and Strategy Book Club II, 3 ECTS

Taiteiden ja suunnittelu korkeakoulu / Högskolan för konst, design och arkitektur / School of Arts, Design and Architecture

DOM-E5089 Games Now!, 3-5 ECTS

ELO-C1021 Kotimainen pitkä elokuva, 2 ECTS

ELO-C4005 Kuvaajavierailut, 1 ECTS

ELO-E1005 Elokuvataiteen vaihtuvasisältöiset kurssit: Trilleri, teoriaosuus, 1-2 ECTS

ELO-E4006 Esitystekniikka, 1 ECTS

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

ENG-E3102 Global Team-based Design Innovation, 10 ECTS

Kon-41.4002 Product Development Project, 10 ECTS

II

Kauppakorkeakoulu / Handelshögskolan / School of Business

20E00200 Public sector hackathon project

21E11001 Dialogues on Corporate responsibility in global economy, 6 ECTS

21C00400 Projektityö ja -johtaminen, 6 ECTS

21C00500 Liikkeenjohdon konsultointi, 6 ECTS

21C00500 Liikkeenjohdon konsultointi, 6 ECTS

23C77051 Myynnin verkkokurssi, 6 ECTS

23E85000 Storytelling - a Narrative Approach for Entrepreneurship, 3 ECTS

23E87050 Meet the Stage: Public Speaking and Interaction Skills, 6 ECTS

25C00200 Entrepreneurship and Innovation Management, 3 ECTS

25E52000 Market Entry Strategies for Entrepreneurial Business, 6 ECTS

31C014100 Russian Economy: Opportunities and Challenges for Doing Business, 6 ECTS

31E12100 Microeconomics: Policy, 6 ECTS

31E00910 Applied Microeconometrics I, 6 ECTS

31E40100 History of Economic Growth and Crises, 6 ECTS

32C060 Verotuksen perusteet, 6 ECTS

32E15100 Kilpailuoikeus I, 6 ECTS

32E25100 Kansainväliset sopimukset, 6 ECTS

Taiteiden ja suunnittelu korkeakoulu / Högskolan för konst, design och arkitektur / School of Arts, Design and Architecture

MUO-E8017 Eco-auditing, 2 ECTS

MUO-E8020 Sustainable Product and Service Design, Theory, 5 ECTS

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

TU-E4000 Changemakers, 1 ECTS

TU-E4060 Design and Innovation in Context, 6 ECTS

TU-E4080 Managing Innovative Sales, 3 ECTS

WAT-E2060 Sustainable Built Environment, 5 ECTS

TU-E3160 Learning and Learning Environments, 3 ECTS

ENG-A1005 Insinööritieteiden tulevaisuusfoorumi, 3 ECTS

III

Kauppakorkeakoulu / Handelshögskolan / School of Business

21C10000 Business and Society, 6 ECTS

21E00052 Data-Driven Business, 6 ECTS

23C77051 Myynnin verkkokurssi, 6 ECTS

23E87050 Meet the Stage: Public Speaking and Interaction Skills, 6 ECTS

26E03200 Managing in a Global Context, 6 ECTS

26E04350 Business Model Design, 5 ECTS

31E00500 International Trade, 6 ECTS

31E13000 Microeconomics: Industrial Organization, 6 ECTS

32A00130 Yritysjuridiikan perusteet, 6 ECTS

32C26000 Yhtiöjuridiikka, 6 ECTS

32E28100 Markkinoiden juridinen toimintaympäristö, 6 ECTS

32E29000 European and International Tax Law, 6 ECTS

Taiteiden ja suunnittelu korkeakoulu / Högskolan för konst, design och arkitektur / School of Arts, Design and Architecture

MUO-E8018 Sustainability Politics, 5 ECTS

MUO-E8017 Eco-auditing, 2 ECTS

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

TU-E4000 Changemakers, 1 ECTS

TU-E4050 Entrepreneurial Leadership, 5 ECTS

III - IV

Kauppakorkeakoulu / Handelshögskolan / School of Business

21C25000 Suoritusten ja palkitsemisen johtaminen, 6 ECTS

21E12002 CAPSTONE in Creative Sustainability, 6 ECTS

31C00200 Makrotaloustiede, 6 ECTS

31C01100 Taloustieteen matemaattiset menetelmät, 6 ECTS

32E36000 Monetizing IPR in Creative Industries, 6 ECTS PERUTTU

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

Kon-41.4014 Internship Innovation Project, 6 ECTS

TU-E4100 Startup Experience, 9 ECTS

TU-A1150 Filosofia ja systeemiajattelu, 3 ECTS

TU-L2010 Videoanalyysi organisaatioiden yhteiskehittämisen tutkimuksessa, 5 ECTS

ELEC-A4930 Astronomical View of the World, 3 ECTS

ELEC-A4920 Sähkötekniikan historia ja innovaatiot L, 3 ECTS

TU-A1140 Itsensä tunteminen ja johtaminen, 3 ECTS

III - V

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

WAT-E2070 Sustainable Global Technologies Studio, 10 ECTS

IV

Kauppakorkeakoulu / Handelshögskolan / School of Business

21C00700 Ympäristö- ja yhteiskuntavastuu liiketoiminnassa, 6 ECTS

23C77051 Myynnin verkkokurssi, 6 ECTS

25C00200 Entrepreneurship and Innovation Management, 3 ECTS

25E18000 Sustainable entrepreneurship, 6 ECTS

26E03400 People Management in Multinational Organizations, 6 ECTS

31E23000 Macroeconomics: Policy, 6 ECTS

31E00600 Open Economy Macroeconomics, 6 ECTS

31E00700 Labor Economics, 6 ECTS

32C31000 Työsuhdejuridiikka, 6 ECTS

32E21010 Rahoitusoikeus, 6 ECTS

32E31100 Kilpailuoikeus, uusi talous ja IPR-oikeudet, 6 ECTS

51E00100 Business Ethics, 6 ECTS

71C09000 Global online collaboration and team management, 6 ECTS

Taiteiden ja suunnittelu korkeakoulu / Högskolan för konst, design och arkitektur / School of Arts, Design and Architecture

MUO-E8022 Creative Cooperation Methods and Skills, 5 ECTS

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

REC-EV Vaihtuvasisältöinen opinto / Affärsjuridikens grunder, 5 ECTS

CSE-E5680 Seminar on Law and Technology,"Exploitation of IPR", 3 ECTS

TU-E4000 Changemakers, 1 ECTS

TU-E4030 Entrepreneurial Finance, 5 ECTS

TU-E4070 Entrepreneurial Marketing, 5 ECTS

IV - V

Kauppakorkeakoulu / Handelshögskolan / School of Business

23C60000 Market Research, 6 ECTS

Taiteiden ja suunnittelu korkeakoulu / Högskolan för konst, design och arkitektur / School of Arts, Design and Architecture

MUO-E8012 Design for Government, 10 ECTS

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

AAN-C2003 ADD Basics: Working in the digital paradigm, 5 ECTS

CHEM-A1620 Näkökulmia ympäristöasioihin, 3 ECTS

V

Kauppakorkeakoulu / Handelshögskolan / School of Business

JOIN-C7002 Design and Creativity in Business, 6 ECTS

23C77051 Myynnin verkkokurssi, 6 ECTS

23E57000 Fashion Marketing, 6 ECTS

31C01300 Energy and Environmental Economics, 6 ECTS

31C00800 Personnel Economics, 6 ECTS

31C00900 Raha- ja pankkiteoria, 6 ECTS

31E17000 African Economic Development, 6 ECTS

31E03000 Investment Decisions in Emerging Markets, 6 ECTS

32E30000 Tax Planning of International Enterprises, 6 ECTS

Tekniikan alan koulut / Tekniska högskolor / Schools of Technology

CSE-E5754 Growth and Internationalization of Technology SMEs, 4 ECTS

TBA

Taiteiden ja suunnittelu korkeakoulu / Högskolan för konst, design och arkitektur / School of Arts, Design and Architecture

ELO-E4510 Äänisuunnittelun metodit: Timothy Nielsen, 1 ECTS

ELO-C4505 Musiikki elokuvakerronnan välineenä, 3 ECTS

Info for admitted students

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Info for admitted students

Registration for courses and exams

The right to study courses or minors will typically be registered within 1–2 weeks after the decision has been made, and you will receive an e-mail notification of the registration. Your right to study is limited only to the specific courses/minor it has been granted for.

Once your right to study has been registered, you can register for courses in WebOodi using your Aalto username and password. Please note, however, that the registration practices, similarly to the other practices of the organising school, might differ from those of your school. That is why you should familiarise yourself with the Into site of the receiving school and particularly with the practical study information. Should you have any problems, you can also contact the learning services of the school or the person responsible at the department organising the course.

If the student is granted a study right for a course, it will not guarantee a place on the course if there is e.g. a quota or priority is given to certain group of students

Duration of the study right

The right to study courses or minors at another Aalto School is always granted for a fixed period: for individual courses, for one year, and for a minor, two years (as an exception, for minors of an extent of less than 18 ECTS, the study right is granted for only a year). Please note that also exams must be taken while your right to study is valid.

If you have not completed all of your studies within the period of validity of your right to study, you will need to apply for a new right to study. Also graduating with a degree from your own school will end your right to study courses or minors at another Aalto School.

Contact information

- School of Arts, Design and Architecture
- School of Business
- School of Chemical Technology
- School of Electrical Engineering
- School of Engineering
- School of Science

University Wide Art Studies UWAS

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University Wide Art Studies UWAS

At Aalto University we believe the future of education exists at the crossroads of science, technology, business and art. University Wide Art Studies (UWAS) offers access to art-based thinking for every discipline in the university through a series of field neutral courses on creativity and culture. These classes are available as equally weighted, credited opportunities for students of all backgrounds, to engage with arts studies as part of their core coursework no matter what their major. This way our University can offer a truly transdiciplinary graduate, someone informed and educated in how art and creative practices shape and define the world around us.

UWAS offer *artistic and creative skills, and art-based thinking for every discipline in the university*. “Art studies” here refers to a wide range of art, design and creative practices, as they are relevant for the various schools and disciplines of Aalto University. Being inherently *transdisciplinary*, UWAS courses are *inclusive* and *available*, based on artistic and design thinking, and its curriculum and pedagogy is *carefully adjusted for the needs, interests and creative potential of non-art disciplines.* It is required and ensured that a substantial number of students participating in every UWAS course represent all the different schools of Aalto. The courses are arranged and scheduled in ways that make participating as easy as possible, ideally integrating the courses as recognized parts of the students’ studies in their own programs.

UWAS-courses are open to all the degree students at the university, regardless of their field of study. **Registration for these courses is done mainly via WebOodi (you don't need to separately apply for a study right for these courses)**, where one can also find more information about the courses.

For more information on UWAS courses, see http://uwas.aalto.fi/

See also Aalto cross-school courses

I - II

kurssin koodi / kurskod / course code	kurssin nimi / kursnamn / course name	ECTS	periodi / period	kieli / språk / language	vastuuopettaja / läraren / teacher in charge

ARTS-A0900	Introduction to visual culture and creative ways of seeing the world	5	I-II	English	Kevin Tavin
ARTS-A0901	Introduction to science and art collaborations: Mixing research, data, methods, and artistic concepts	3-5	I-II	English	Andy Best
MUO-C0005	Design theory and methodology	5	I-II	English	Oscar Person

I - V

kurssin koodi / kurskod / course code	kurssin nimi / kursnamn / course name	ECTS	periodi / period	kieli / språk / language	vastuuopettaja / läraren / teacher in charge
ELO-E5016	Scenography, production design and costume lectures	1-4	I-V	suomi / English	Liisa Ikonen, Kaisa Mäkinen, Sofia Pantouvaki

II

kurssin koodi / kurskod / course code	kurssin nimi / kursnamn / course name	ECTS	periodi / period	kieli / språk / language	vastuuopettaja / läraren / teacher in charge
ARTS-A0902	Visualize me: Creative ways of thinking and using visual tools	5	II	English	Laura Isoniemi
ARTS-A0903	Method Madness: Experimentation, breaking boundaries, and disruptive art through creative team work	5	II	English	Katriina Haikala, Vilma Metteri
ARTS-A0904	Unavoidable Darkness - Interventions in Urban Space	5	II	English	Pia Euro, Taina Rajanti

III

kurssin koodi / kurskod / course code	kurssin nimi / kursnamn / course name	ECTS	periodi / period	kieli / språk / language	vastuuopettaja / läraren / teacher in charge
ARTS-A0906	Introduction to sound culture: Audio across disciplines	5	III	English	Antti Ikonen
MUO-C0110	What to design?	5	III	English	Heidi Paavilainen

III - IV

kurssin koodi / kurskod / course code	kurssin nimi / kursnamn / course name	ECTS	periodi / period	kieli / språk / language	vastuuopettaja / läraren / teacher in charge
ARTS-A0909	The science of storytelling: Narrative in short film scripts	5	III-IV	English	Vesa Kantola
ARTS-A0911	Digital Scupture: 3D models & animation as a creative, multidisciplinary tool	5	III-IV	English	Andy Best

III - V

kurssin koodi / kurskod / course code	kurssin nimi / kursnamn / course name	ECTS	periodi / period	kieli / språk / language	vastuuopettaja / läraren / teacher in charge
ARTS-A0900	Introduction to visual culture and creative ways of seeing the world	5	III-V	English	Kevin Tavin
ARTS-A0910	Art and social impact: Creating multidisciplinary exhibitions	5	III-V	English	Katriina Haikala, Vilma Metteri
MS-E1000	Crystal Flowers in Halls of Mirrors: Mathematics meets Art and Architecture	5-15	III-V	English	Kirsi Peltonen

IV

kurssin koodi / kurskod / course code	kurssin nimi / kursnamn / course name	ECTS	periodi / period	kieli / språk / language	vastuuopettaja / läraren / teacher in charge
MUO-C0111	How to design?	5	IV	English	Teppo Vienamo

IV - V

kurssin koodi / kurskod / course code	kurssin nimi / kursnamn / course name	ECTS	periodi / period	kieli / språk / language	vastuuopettaja / läraren / teacher in charge

ARTS-A0905	Aalto Artist in Residence Workshop	5-10	IV-V	English	Harri Laakso
ARTS-A0907	Social/physical landscape photography	5	IV-V	English	Harri Laakso

ARTS minors for all Aalto students

In the guide, the minors offered by the School of Arts Design and Architecture (ARTS) have been classified under two headings: ARTS minors for all Aalto students and ARTS minors only for ARTS students.

On the page **ARTS minors for all Aalto students** you can find information about those ARTS minors which are primarily open for all Aalto University students. Please note that some of such minors may, however, be offered only to students of certain majors/departments.

Under **ARTS minors only for ARTS students**, you can find information about those minors which are intended only for students of ARTS.

The more specific target groups of each minor are explained in the descriptions of the minors. The descriptions also provide information on the application procedure and any restrictions regarding applicants.

ARTS minors for all Aalto students

Minor	Extent (ECTS)	Language of instruction
BACHELOR'S LEVEL MINORS		
Animation	15-25	Finnish / English
Audiovisual Storytelling and Dramaturgy	15-25	Finnish (some courses in English)
Audiovisual Project Management	15-25	Finnish / English
Cinematography	15-25	Finnish
Comics Minor Studies	25	Finnish
Design	15	Finnish
Documentary Film	15-25	Finnish (some courses in English)
Film Editing	15-25	Finnish
Film History	15-25	Finnish (some courses in English)
Futures Studies	25	Finnish
History of Architecture (bachelor's level)	15-25	Finnish
Media Minor	15-25	Finnish
Scenography and Costume Design	15-25	Finnish / English
Urban Academy	15-25	Finnish
Urban and Regional Planning	15-25	Finnish
MASTER'S LEVEL MINORS		
Audiovisual Entrepreneurship	15-30	Finnish / English

Audiovisual Storytelling and Dramaturgy	15-25	Finnish (some courses in English)
Cinematography	15-25	Finnish / English
Creative Sustainability	15-25	English
Curating, Managing and Mediating Art	15-25	English
Documentary Film	15-25	Finnish (some courses in English)
Dynamic Visualization in New Media	25	English
Experimental Design	20	English
Fashion Management	24-30	English
Film Editing	15-25	Finnish
Film History	15-25	Finnish (some courses in English)
Game Design and Production	15 or 25	English
History of Architecture (Master's level)	15-25	Finnish
International Design Business Management (IDBM)	25	English
Media Minor	15	Finnish
Nordic Visual Studies and Art Education (NoVA)	15	English
Pack-Age: Interdisciplinary Packaging Design Project	15	English
PatternLab	15-20	English
Scenography and Costume Design	15-25	Finnish / English
Sound in New Media	15-25	English
Textiles – Material and Structure	16-25	English
USchool	20	Finnish / English
Visual Culture and Contemporary Art	15 or 25 (-27)	English

Animation

Basic information of the minor

Code: ARTS3072

Extent: 15-25 ECTS

Language: Finnish or English

Professor in charge: Anne Lakanen

Administrative contact: Study Coordinator Ilona Virtanen

Target group: Primarily students of ELO and Aalto ARTS; some courses are available for all students of Aalto University and of the University of the Arts Helsinki.

Application procedure:

The normal application periods for internal mobility and JOO (flexible right to study) apply.

Application period and instructions for Aalto University students:

- application period from 1 May to 15 May 2016.
- no admissions in Autumn term 2016
- Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Students of other Finnish universities apply for the minor during the JOO application period in the JOOPAS system https://haku.joopas.fi

Along with the application, students are required to submit a motivation letter and a preliminary plan on minor studies.

Number of available places and restrictions: Some courses are open for all, while for productions, no more than 16 students are admitted per academic year. The only application period for the minor is in Spring. If there are more eligible students than places are available, ARTS students majoring in Film and Television and Scenography will be given preference.

Prerequisities: see Number of available places and restrictions

Name of the minor in other languages: Animaatio (fi), Animerad film (swe)

Content and structure of the minor

Learning outcomes

Students will gain insight into the particular characteristics, methods and possibilities of animation, and learn about the variety and job descriptions of the field. The minor develops and complements the students' technical skills in making an animated film. Students acquire professional practices of making an animated production.

Content of the minor

The studies allow students to deepen their knowledge of methods of character animation through exercises, analysis and animation history. Animation techniques include puppet animation, cutout animation, object animation and hand-drawn animation, digital 2D or 3D animation and combinations of the different animation techniques. Students familiarise themselves with the possibilities offered by animation in different expression forms, different film genres (fiction and documentaries), in games and on the internet, as well as the use of virtual characters and sets as well as special effects. The minor includes courses in screenwriting, production design, sound design and editing, all adapted to animation.

The contents of the minor are tailored for each student as agreed with the teacher-in-charge of the minor. Students choose an entity suitable for their learning objectives (15–25 cr) from the course selection of the minor. Other students than ELO students are recommended to take the courses ELO-C3013 Avid 1 and ELO-C3038 Adobe Premiere to gain the prerequisite knowledge.

Structure

Code	Name	Credits
Research-Oriented Thinking		
ELO-C3039	Basics in Animation Expression	1-3
Animation Exercises		
ELO-C3040	Hahmon elävöittäminen	2-4
ELO-C3041	Idea to Manuscript	2-4
ELO-C3042	Suunnitelmasta storyboardiksi	1-2
Basics of Animation Production		
ELO-C3043	Animatic ja tuotantoesittely	1-2
Set Design and Character Creation in Animation		
ELO-C3044	Workshop, lavastus, rekvisiitta	1-6
Animation Filming		
ELO-C3045	Animaatiokuvaus ja valaisu sekä animointi	4-14
Post Production		
ELO-C2510	Editing	1-2
ELO-C3047	Sound Design	1-6
ELO-C3048	Digitaalinen kuvankäsittely	1-6
Technology (Recommended)		
ELO-C3013	AVID 1	1
ELO-C3038	Adobe Premiere	1
		15-49

The official English names of the courses to be announced later.

Audiovisual Entrepreneurship

Basic information of the minor

Code: ARTS3037

Extent: 15-30 ECTS

Language: Finnish or English

Organizing department: Department of Film, Television and Scenography

Teacher in charge: Aleksi Bardy

Administrative contact: Study Coordinator Ilona Virtanen

Target group: Open minor

Application procedure:

The normal application periods for internal mobility and JOO (flexible right to study) apply.

Application period and instructions for Aalto University students:

- application period in Spring: from 1 to 15 May 2016.
- application period in Autumn: from 15 to 30 September 2016.
- Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Students of other Finnish universities apply for the minor during the JOO application period in the JOOPAS system https://haku.joopas.fi

Minor students are required to have prior knowledge of the audiovisual field (for example, through education in another major or professional experience), good English skills, and a commitment to the field and its development demonstrated in a motivation letter.

Quotas and restrictions: 0-4 students are selected per academic year.

Prerequisites: a background in the subject is a prerequisite (see the application procedure)

Name of the minor in other languages: Audiovisuaalinen liiketoiminta, Audiovisuell affärsverksamhet

Content and structure of the minor

The student gains an understanding of the philosophy of audiovisual entrepreneurship, the changing operating environment and creative management.

This tailored minor entity consists of courses on the current state of audiovisual entrepreneurship, such as marketing, business planning, international co-productions and other key elements relating to the topic. The courses are mainly MA-level courses from the Film and Television Producing course offering.

As part of the study module, the student completes an analytical essay, either entirely in writing or as a combination of a written and a practical section. The essay is 10-15 pages (only in writing) or 5-10 pages (written + practical). The practical section can be related to an exercise carried out at the school or to a production outside the school. The entity can also be completely entirely in English.

Audiovisual Project Management

Basic information of the minor

Code: ARTS3038

Extent: 15-25 ECTS

Language: Finnish or English

Organizing department: Department of Film, Television and Scenography

Teacher in charge: Aleksi Bardy

Administrative contact: Study Coordinator Ilona Virtanen

Target group: Open minor

Application procedure:

The normal application periods for internal mobility and JOO (flexible right to study) apply.

Application period and instructions for Aalto University students:

- application period in Spring: from 1 to 15 May 2016.
- application period in Autumn: from 15 to 30 September 2016.
- Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Students of other Finnish universities apply for the minor during the JOO application period in the JOOPAS system https://haku.joopas.fi

Minor students are required to have prior knowledge of the audiovisual field or education in production or another field. Participation in teaching generally requires fluency in Finnish and English. The application must include a motivation letter that also outlines the applicant's earlier experience.

Quotas and restrictions: 0-4 students are selected per academic year.

Prerequisites: a background in the subject is a prerequisite (see the application instructions)

Name of the minor in other languages: Audiovisuaalinen projektinjohto, Audiovisuell projektledning

Content and structure of the minor

After completing the minor, the student can plan and manage audiovisual productions.

The tailored minor entity consists of project management courses (division of work, scheduling, budgeting, project management, management, etc.). The courses are mainly BA-level courses from the Film and Television Producing course offering.

The minor entity includes participation in the production management of one school exercise (course work, intermediate work or BA/MA film, as a production manager, assistant director or producer).

The entire course content is planned on an individual basis according to the student's needs, earlier studies and competence as well as the other course offering.

Curating, Managing and Mediating Art

Basic information of the minor

Code: ARTS3064

Extent: 15-25 ECTS

Language: English

Teacher in charge: NN (*to be announced later*)

Target group: No intake in 2016. Students from Aalto ARTS and generally from Aalto University, who are interested and have experience in curating and mediating art, and who are able to insert the minor as part of their degree (primarily students from other master programmes in the Department of Art and Aalto ARTS).

Level of the minor: Master level

Application procedure:

No intake in 2016. The applicant will apply through eAge in Aalto and in addition he/she is expected to write a motivation letter (max 1 A4 sheet) to describe the former experience, interests and aspirations to make the CuMMA minor.

The selection criteria are student's earlier performance in studies related to the field of the minor and a motivation letter, where student's former experience, interests and aspirations are stated.

The selection criteria are student's earlier performance in studies related to the field of the Minor and a motivation letter, where student's former experience, interests and aspirations are stated.

Quotas and restrictions: A maximum of 4 students are accepted to the minor every second year. Limitations: Students of CuMMA and ViCCA majors, since the minor courses are part of their major studies.

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

Learning outcomes

The CuMMA Minor concentrates on contemporary arts and its publics. The studies develop comprehensive and innovative knowledge in critical curating, managing and mediating art. The students learn about the multifaceted theoretical and practical sceneries of the art world. On the CuMMA Minor the art world is explored together with the acting artists and professionals, and within the institutions of the national and international art field.

Content

CuMMA Minor gives an introduction to theoretical backgrounds and practices of curating, managing and mediating on the field of art. The students will have a personal study plan for CuMMA Minor and their studies will be done alongside with the students of the CuMMA Major, bringing their personal knowledge and viewpoint to the CuMMA community.

Timing

No intake 2016.

Structure of the minor

Code	Name	Credits
CuMMA minor of 15-25 ECTS consists of altogether 3-5 CuMMA courses selected from a variety of nine (9) courses. The optional courses are:		
TAI-E3403	Theoretical Frameworks of Curating and Mediating Art	5
TAI-E3404	Practices of Producing and Exhibiting Art	5
TAI-E3405	Tools of Curating, Managing and Mediating Art	5
TAI-E3406	Contemporary Art and Art Exhibition as Learning Environment	5
TAI-E3414	CuMMA Project	6
TAI-E3408	Exhibition and Text Workshop	5
TAI-E3409	Art, Everyday Life and Society	5
TAI-E3410	Critical Management in Curating	5
TAI-E3412	Artistic and Curatorial Research Methodology	5

Aalto ARTS' Minors guide 2016-17 will be under construction until July 30th.

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Creative Sustainability

Basic information of the minor

Code: CS.a

Extent: 15-25 ECTS

Language: English

Teacher in charge: Mikko Jalas

Administrative contact: Study Coordinator Naoko Nakagawa

Target group: Aalto University Master level students

Application procedure:

An applicant should be a master student of Aalto University and have an interest in multidisciplinary teamwork. Application documents: a free-form letter of motivation, CS study plan, CV and student`s academic record (transcript). All documents should be in English.

The application time for the academic year 2016-2017 is 1.-15. May 2016. Instructions for applying will be found on Into website.

Please attach all the required application documents when you fill in the eAge application form. Newly accepted Aalto students who do not have the Aalto password can apply by sending the required application documents directly to the study coordinator *Naoko Nakagawa*.

Students from other Finnish universities apply via JOOPAS https://haku.joopas.fi.

More information: Study Coordinator *Naoko Nakagawa*: naoko.nakagawa@aalto.fi Address for newly accepted students for sending the applications: *Naoko Nakagawa*, Creative Sustainability Study Coordinator, Aalto University School of Arts, Design and Architecture, PL 31000, 00076 Aalto, Finland.

Quotas and restrictions: Altogether 30 students from all the Schools of Aalto. An applicant should be a master student of Aalto University and have an interest in multidisciplinary teamwork. CS steering group will accept the minor students based on the application documents.

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

The minor is multidisciplinary. Contributing schools: Aalto ARTS/ Department of Architecture and Department of Design, Aalto BIZ/ Department of Management Studies and Aalto ENG/ Department of Built Environment.

http://acs.aalto.fi/

Learning outcomes

The Creative Sustainability minor study is offered to all master's student in Aalto University in order to help to broaden and deepen sustainability knowledge and get acquainted with multidisciplinary approach during one's own master degree studies.

The minor supports particularly such skills that are needed in the planning and designing of sustainable solutions in the built environment and in the management of both design and business innovation and those social conflicts that are inherent in the sustainability agenda. Minor in CS provides opportunities to develop and make use of one's knowledge in other areas of study. On the other hand, the minor contributes to sustainability expertise. The interdisciplinarity of the programme will enhance the understanding of the work practices of sustainability experts from different fields as well the skills of communication about sustainability.

Content

The Creative Sustainability minor studies offer a possibility to study sustainability courses in international and multidisciplinary teams. Studies combine insights and courses from systems

thinking, sustainable urban and building design, responsible business, sustainable product and service design, environmental impact assessment of landscape planning, real estate and global development issues.

Timing

Timing of the minor in the teaching periods of the academic year: one academic year

Structure of the minor

Code	Name	Credits
Students can choose courses from the following list:		
Arts/department of design		
MUO-E8020	Sustainable Product and Service Design, Theory	5
MUO-E8017	Eco-auditing	2
MUO-E8021	Participatory Methods and Facilitation Skills	5
MUO-E8022	Creative Cooperation Methods and Skills	5
MUO-E8012	Design for Government	10
MUO-E8014	Theoretical Changing Courses	1-12
MUO-E8015	CS Project	1-12
MUO-E8018	Sustainability Politics Sustainability studies in other universities	5
Arts/department of architecture		
ARK-E3505	Sustainable Building Design	10
ARK-E5505	Sustainable Urban Design	10
MAR-E1024	Sustainable Landscape – EIA, Studio	10
ARK-E5504	Cities in Transition, Studio (Notice: “WAT-E2060 Sustainable Built Environment” should be completed first.)	10
School of business		
21E12002	CAPSTONE in Creative Sustainability	6
21E16000	Sustainable business & consumption	6
21E10000	How to change the world: Innovating toward Sustainability	6
21E11001	Dialogues in Corporate Responsibility in Global Economy	6
22E29100	Accounting for Sustainability	6
51E00100	Business Ethics	6
21E06050	Responsibility Management, book exam	6
25E18000	Sustainable Entrepreneurship	6
School of engineering, Department of Built Environment		
REC-E1010	Real Estate Economics	5
REC-E1020	Property Right, Cadaster and Planning	5
REC-E1030	Facility and Property Management	5
REC-E3010	Real Estate Business and Entrepreneurship	5
REC-E3030	Property Development	5
Yhd-12.3081	State of the World and Development	2
WAT-E2060	Sustainable Built Environment	5
WAT-E2070	Sustainable Global Technologies Studio (“Yhd-12.3081 State of the World and Development”	10

and “WAT-E2060 Sustainable Built Environment” should be completed first.)

Aalto ARTS' Minors guide 2016-17 will be under construction until July 30th.

Dynamic Visualization in New Media

Basic information of the minor

Code: ARTS3048

Extent: 25 ECTS

Language: English

Teachers in charge: Lily Diaz, Markku Reunanen

Target group: only masters level students

Application procedure:

Internal mobility: Application time for Aalto University students for Dynamic Visualization in New Media minor subject studies (25 credits) is May 1.-15.2016 Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Students from other Finnish universities apply during the JOO application time in April 1.-30.2016 via JOOPAS https://haku.joopas.fi.

Needed attachments are a transcript of records and a motivation letter. In the letter the applicant describes one's background and experience relating to the minor subject applied for as well as indicates one's learning objectives. Experience in working with digital media is recommended.

Selection criteria: 1) educational background relating to the minor subject, 2) working experience or other experience relating to the minor subject, 3) feasible learning goals relating to the minor subject

Quotas and restrictions: 3-8 available places, no quota.

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

Learning outcomes

From a practical point of view, this thematic area seeks to develop competence in visualization as a key aspect of digital design, with the objective of developing visual literacy and using this skill in the creation of effective information and communication products.

From a theoretical point of view, the aim is to provide an understanding of the context of visualization as one involving dynamic processes that are of a biological as well as of a social and cultural nature. The course's focus is on the nature of these processes as well as the role of visualization within them.

Content

Visualization involves the manipulation of abstract elements, since in many instances its objective is to provide knowledge about phenomena whose essence is not visual, or about artifacts that do not yet exist. For example, a map of its stations does not really resemble a metro itself but rather, outlines the different parts of the system, their location, as well as the process of moving from one part to another.

Visualization is closely related to the notion of communication in contemporary culture. The idea of the artist or the designer as an expert in visualization, pre-supposes acquiring familiarity with the iconographic systems of diverse visual cultures. From this point of view the designer works like the anthropologist; s/he becomes familiar with the visual artifacts of the audience s/he is supposed to design for.

Structure of the minor

Code	Name	Credits
These courses are obligatory in dvd minor subject studies		
DOM-E2010	Information Design 1	3
DOM-E5033	Dynamic Visualization 1	5
DOM-E5034	Dynamic Visualization 2	6-8
Student can collect the rest of the needed 25 ECTS credits from these courses.		
These courses will be organized every year:		
DOM-E5108	From Data to Pixels	3
DOM-E5012	Interface Prototyping	3
DOM-E5026	Dynamic Visualization Independent Studies	3-6
DOM-E5103	Topics in Visualization ad Cultural Analytics	3-6
These courses are taught only every second year:		
DOM-E5003	Systems of Representation	3-6
DOM-E5057	Information Graphics; Formats and Genres	3
DOM-E5025	3D User Interface Design	3-6

Aalto ARTSin sivuaineopas 2016-17 on muokkauksen alla 30.6.2016 asti.

Experimental Design

Basic information of the minor

Code: ARTS3079

Extent: 20 ECTS

Language: English

Responsible teacher: Timo Salli

Administrative contact: Study Coordinator Birgitta Tuomaala

Target group: Experimental Design is a minor programme aimed at master-level students from other study programmes in Aalto and other universities, who have basic competences in visual design and want to deepen their understanding on contemporary professional practices and competences in design. Depending on the chosen courses, students with varying earlier experience will increase their understanding in experimental product or spatial design.

Application procedure:

Application to the programme can be done either via Aalto University eAge system's internal minor application process, or under JOO agreement from other Finnish Universities.

Application time for Aalto students is 1.-15.5.2016 Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Students from other Finnish universities apply via JOOPAS https://haku.joopas.fi.

Upon application students must include to their application material their official Personal Study Plan (from their own major programme), a motivational letter including the contents selected from the minor and a portfolio showcasing their previous experience in design. This material can be attached either directly in eAge online system, or then by including the aforementioned material to sent application documents.

The motivational letter should bring forth the student's earlier studies and experience in relation to design, and their areas of interest and ideas for further work. The applicant is asked to identify the preferred courses, along with some alternative choices, and to justify these choices in relation to their earlier studies and their official Personal Study Plan.

Selection is done according to the portfolio, Personal Study Plan and motivational letter.

Quotas and restrictions: Max 20 students. Many of the courses offered for the minor have their course specific quotas and restrictions.

Prerequisites: Bachelor degree. See also application procedure and quotas and restrictions

Name of the minor in other languages: Kokeilevan muotoilun sivuaine

Content and structure of the minor

Learning outcomes

Minor in Experimental Design provides students improved understanding of design in relation to contemporary culture and innovation practices. It accustoms the students to understand design in

creative, academic and/or entrepreneurial settings, extending design into emerging fields in which design can enhance the quality of environment and people's life. The students will improve their ability to understand and participate in design collaboration, and to bring forth a designerly mode of thinking and making.

Content: The minor in Experimental Design provides a selection of courses from Master of Art programmes in Product and Spatial Design as well as Collaborative and industrial design. The learning is built on problem- and project-based learning, and several of the courses involve a project addressed in cross-disciplinary teams. The courses develop skills to work with contemporary product development and manufacturing processes, form giving, prototyping and industrial collaboration. The objective is to educate designers who are able to combine social responsibility and creative interpretation of beauty, skillfully employing various methods of empirical research. The aim is to strengthen 3D understanding by combining different scales, materials and disciplines into the contextual framework. The courses deepen student's ability to reflect on their work in a wider cultural context and conduct experiments in product development. The studies include design projects related to everyday living, functional objects, and unique pieces.

Timing: Minor studies are available through the academic year and its contents are organized annually. Selected students take part in two courses, organized in different study periods, during which they are expected to work full-time.

Structure of the minor

The applicants of the minor must select two courses. As the places on the courses may be limited, the students are recommended to identify also few alternatives to their primary selection. Upon application the applicants are asked to justify their choices in their written study plan. Furthermore, the selected minor contents must be compatible with the student's Personal Study Plan.

The courses are selected from the list below.

Code	Name	Credits
MUO-E3000	New Materials and Means of Production	10
MUO-E3001	Product Architecture Design	10
MUO-E3019	Form Exploration	10
MUO-E1026	Design-Driven Foresight	10
MUO-E5016	Woodstudio	10
MUO-E5004	Neglected Space	10
MUO-E5006	Identity of Space	10
MUO-E5009	Experimental Design	10
MUO-E5010	Design Exploration and Experimentation	10
MUO-E5011	Material Experimentation and Research	10

Aalto ARTS' Minors guide 2016-17 will be under construction until July 30th.

Fashion Management

Basic information of the minor

Code: ARTS3059

Extent: 24-30 ECTS

Language: English

Organizing department: Department of Design

Teachers in charge: Pirjo Hirvonen (ARTS) and Pekka Mattila (BIZ)

Administrative contact: Study Coordinator Laura Pellikka

Target group: MA students of Fashion and Collection Design (Aalto ARTS Department of Design) and MSc students of Marketing' (Aalto BIZ Department of Marketing) in priority

Application procedure: Common application period twice a year:

- in autumn to courses starting next spring
- in spring to courses starting next autumn

Application time for Aalto University students is 1.-15.5.2016 Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Students from other Finnish universities apply during the JOO application time via JOOPAS https://haku.joopas.fi.

Upon application students must include to their application material their official Personal Study Plan (from their own major programme) and Letter of Intent (with the two preferred courses and their alternatives). This material can be attached directly in eAge online system.

In the Letter of Intent the student is asked to identify the preferred courses, along with some alternative choices, and to justify these choices in relation to their earlier studies and their official Personal Study Plan.

Selection is done according to Personal Study Plan and Letter of Intent and overall suitableness of the student.

Quotas and restrictions: Max. 30–35 students (10 ARTS + 15 BIZ + max 10 other AALTO-schools or other universities)

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

Learning outcomes

Having completed the minor the students have deepened their knowledge and skills in fashion marketing considering the demands of international fashion business field. The multidisciplinary

networking and the developing of the communication between the different professionals are also an essential part of studies.

Content

The minor consists of courses in fashion marketing, fashion communication, custom behavior and trend forecasting. The teaching responsibilities are divided between Aalto ARTS Department of Design and Aalto BIZ Department of Marketing.

Structure of the minor

- Students from BIZ choose at least one module from ARTS courses. Students from ARTS choose primarily from BIZ cources.
- Other students from AALTO or other universities can personalize their minor with tutoring teacher

Code	Name	Credits
BIZ students choose at least one of the following 10 ects modules:		
MUO-E1026	Design-Driven Foresight	10
MUO-E1011	Fashion Communication	10
MUO-C1035	History of Fashion	4
Fashion and Collection Design program students choose primarily from following courses:		
23E57000	Fashion Marketing	6
23E58050	Customer Behavior, Retail Experience and Fashion	6
23E48000	Consumer Psychology	6
23C72050	Customer Experience Management	6
23E59000	Sustainable Marketing	6

Please note: acceptance to the minor does not automatically confer the right to take the course 23E5700 Fashion Marketing. Students wishing to include 23E57000 in their minor studies must send in a separate application in line with course protocol. Please see www.aaltofashionmarketing.com for details.

Game Design and Production

Basic information of the minor

Code: ARTS3049

Extent: 15 or 25 ECTS

Language: English

Teachers in charge: Miikka Junnila

Target group: Only masters level students.

Application procedure:

Internal mobility: Application time for Aalto University students for Game Design and Production minor subject studies (15 or 25 credits) is 1-15.5.2016 Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Students from other Finnish universities apply during the JOO application time 1-30.4.2016 via JOOPAS https://haku.joopas.fi.

Needed attachments are a transcript of records and a motivation letter. In the letter the applicant describes one's background and experience relating to the minor subject applied for as well as indicates one's learning objectives. We strongly recommend that the applicants provide links to videos and/or other documentation about their past games, software, art, design etc.

Selection criteria: 1) educational background relating to the minor subject, 2) working experience or other experience relating to the minor subject and 3) feasible learning goals relating to the minor subject.

Quotas and restrictions: 3-10 students.

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

Learning outcomes

The learning outcomes of the minor are

- to understand what games and game design are,
- how games are analyzed and
- how they are made in multidisciplinary groups.

Content

The minor subject in game design and production offers the student an opportunity to understand more about games and game production. Alternative versions are worth of 15 ECTS or 25 ECTS.

We encourage students to choose this 25 ECTS version of the minor subject, as that gives the student a full experience of the hands-on aspect of game design and production during the game project. We hope that the applicant has a strong interest in games and experience in some relevant skill like for example game design, art, animation or programming.

Structure of the minor

Game Design and Game Analysis courses are obligatory for all Games minor students. Game Project is either 5 ECTS credits or 15 ECTS depending on the size of the minor studies.

Code Name Credits

DOM-E5080 Game Design 5
DOM-E5083 Game Analysis 5
DOM-E5095 Game Project 5-15

Aalto ARTS' Minors guide 2016-17 will be under construction until July 30th.

Nordic Visual Studies and Art Education

Basic information of the minor

Code: ARTS3083

Extent: 15 ECTS

Language: English

Teacher in charge: Mira Kallio-Tavin

Level of the Minor: Advanced

Teaching periods: One academic year

Target group: Minor in Nordic Visual Studies and Art Education is a minor programme aimed at students from other master's programmes in Aalto ARTS, other Aalto schools and other art universities in Finland, who want to develop competences in media literacy, visual communication, and contemporary visual culture and art, when working with different audiences, communities and individuals, and to draw upon contemporary visual cultural theory, art theory, cultural practices, and pedagogical encounters.

Quotas and restrictions: Maximum of 8 master-level students

Application procedure: Please notice that this minor programme is arranged every other year. Application to the minor programme can be done via Aalto University eAge system's internal minor application process. Application time for Aalto students is 1.-15.5.2016. Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Students from other Finnish universities apply via JOOPAS: https://haku.joopas.fi

Upon application students must include to their application material their official Personal Study Plan (from their own major programme), a motivation letter and transcript. This material should be attached directly in eAge online system.

The motivation letter should bring forth the student's earlier studies and experience in relation to art, design, visual studies and pedagogy, and their areas of interest and ideas for further work.

Selection is done according to the motivation letter and overall suitableness of the student.

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

Learning outcomes

- The student will have a good understanding of site- and time-specific and participatory art, and make statements about the roles and relationships between various actors in contemporary art, and be able to critically reflect upon the concepts of public sphere and democratic participation
- The student will have the capacity to critically analyse, interpret, respond, and reflect upon images, objects, and sites in everyday life through theories of visual culture, and to describe and analyse the nexus between visual images, meanings, and their social contexts
- The student will develop and discuss views about cultural and social diversity, challenge the normative thinking, and understand different art pedagogical practices, traditions and theories in different countries, cultures and communities

Content of the minor

The minor focuses on contemporary visual culture and art pedagogy by examining the theory, methodology and practice of the field.

Structure of the minor

Code	Name	Credits
Compulsory courses		
TAI-E4011	Theories and practices of visual culture	5
TAI-C1105	Intercultural seminar	5
TAI-E4014	Contemporary art and its social context	5

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Pack-Age: Interdisciplinary Packaging Design Project

Basic information of the minor

Code: ARTS3050

Extent: 15 ECTS

Language: English

Teachers in charge: Markus Joutsela, Packaging design researcher and teacher

Administrative contact: Study Coordinator Sara Rönkkönen

Target group: Aalto University students who are interested in packaging design and interested in working with real projects.

The Pack-Age minor prepares students for project work typical in working life, often involving cooperation with experts from many different fields. The student learns to utilize one's special competence as part of a project and thus strengthen the team's expertise.

Applying to a minor: Application procedure: Students apply by means of written motivation letters. The motivation letter should include the following information

- Why are you applying and what expectations do you have for Pack-Age?
- What are you enthusiastic about and what interests you in packaging?
- What kind of competence do you bring to the project?
- Do you have experience of project work or experience with packaging industry?
- Would be interested in serving as project manager in your group,
- Do you have a lot of other studies going on simultaneously?
- Why should you be selected for the minor?

The application period is 1. September – 30. October 2016. Students can apply for the minor module by sending a motivation letter to pack-age@aalto.fi by 30 October 2016. In addition, the student may optionally attach work samples to the application in pdf format (max. 5 MB).

Based on motivation letters, the teachers of Pack-Age will form the project groups before the course begins. Each project group should have highly motivated students from different disciplines and backgrounds. One student serves as the project manager in each group. The project teams are often multinational.

Selection criteria:

- Motivation
- Educational background
- Interest and experience
- Suitability for the project
- Available time (not many overlapping courses)

Quotas and restrictions: 20 students will be admitted to the minor, 16 from Aalto University schools and 4 packaging design students from Lahti Institute of Design and Fine Arts.

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

The minor is taught in collaboration between four different schools: Aalto ARTS, Aalto BIZ, Aalto CHEM and Lahti Institute of Design and Fine Arts. Pack-Age is organised by the Aalto ARTS Master's Programme in Graphic Design.

Learning outcomes

Content outcomes:

- The student understands the many purposes of a package and knows how the packaging value chain is constructed. S/he understands how a package can serve different stakeholders in different phases of the product's life cycle.

- The student knows the principles of visual, structural and user-centred packaging design that complies with sustainable development, and is able to evaluate the feasibility of a packaging solution from many different perspectives.

Skill outcomes:

- As a part of a project group the student is able to create a fit-for-purpose design solution taking into account the client, product, environment, and the user.
- The student is able to present and justify their design solution. S/he can describe from a number of perspectives what kind of impact the design has and what value it brings.
- The student is familiar with good project work practices and can function responsibly as a member of a project group and knows how to communicate with various stakeholders.

Content of the Minor

The students work in groups on company projects. The learning tasks involve designing future packaging concepts and package prototypes. The learning content consists of theme lectures and workshops as well as independent and supervised group work.
Teaching is based on collaboration between different teachers and schools. Utilizing competence and cooperation networks makes it possible to offer more comprehensive and holistic approach to teaching and learning packaging design.

The teaching themes are:

- Graphic design and packaging structures
- Material technology and packaging engineering
- Sustainable product design
- Design for user experience
- Marketing, branding and consumer research
- Package development and model making

Structure of the minor

The minor is organised as one long project-style course. Teaching takes place in periods IV-V. Prior to the start of teaching, the project groups will be created on the basis of the applicants' skills, backgrounds and interests.

Code	Name	Credits
DOM-E1018	Pack-age	15

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Scenography and Costume Design

Basic information of the minor

Code: ARTS3043

Extent: 15-25 ECTS

Language: Finnish or English

Department: Department of Film, Television and Scenography

Teachers in charge: lecturer Merja Väisänen

Coordinator: study coordinator Tuuli Kettunen

Target group: Open for everyone

Application procedure:

Application to the programme can be done either via Aalto University eAge system's internal minor application process, or under JOO agreement from other Finnish Universities.

Students of the University of the Ars apply through AaltoARTS mobility studies.

- Application time in the spring term: 1.-15.5.2016
- Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Students from other Finnish universities apply via JOOPAS https://haku.joopas.fi.

The applicant has to write a letter of motivation, a preliminary plan of one's minor studies and 1-3 examples of artistic or research work. The work examples will be sent in digital form (as one pdf document) with other application materials.

Selection criteria: motivation and the level of artistic or research work examples.

Quotas and restrictions: No limitations. The number of new minor students per year is max 6. Accepted minor student has to make a study plan with the teacher in charge of the minor in the beginning of the next semester and start the minor studies during the same academic year. The study right for the minor will be awarded to the two year period.

Prerequisites: Please see application procedure and quotas and restrictions.

Name in other languages: Scenographi och kostymdesign, Lavastustaide ja pukusuunnittelu

Content and structure of the minor

After having completed minor of 15-25 credits, the student has an understanding of different areas in Performing and Screen Arts Design and the content, possibilities and responsibilities of set or costume designer's work. The student is able to apply the learning from different courses from the minor to one's further studies and career.

The minor studies can be emphasized either on production design, scenography or costume design or it can be a combination of them. The information on the possible emphasis can be added to the student's certificate when graduating.

The structure and content of the minor will be tailored individually with each student in a meeting with the responsible teacher of the minor. The student is able to choose a 15-25 cr selection of courses based on his/her learning goals. For an international/foreign student the minor will be tailored from the courses available in English. Please contact the study coordinator for more information.

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Sound in New Media

Basic information of the minor

Code: ARTS3052

Extent: 15 or 25 ECTS

Language: English

Teachers in charge: Antti Ikonen

Target group: only masters level students

Application procedure:

Internal mobility: Application time for Aalto University students for Sound in New Media (SOiN) minor subject studies (15 or 25 credits) is 1.-15.5.2016. Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

JOOPAS: Students from other Finnish universities apply during the JOO application time 1.-30.4.2016 via JOOPAS https://haku.joopas.fi.

Needed attachments are a transcript of records and a motivation letter. In the letter the applicant describes one's background and experience relating to the minor subject applied for as well as indicates one's learning objectives. Experience in working with digital media is recommended.

Selection criteria:

1. educational background relating to the minor subject
2. working experience or other experience, relating to the minor subject
3. feasible learning goals related to the minor subject

Quotas and restrictions: 3–5, no quota

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

Learning outcomes

To understand more about sonic dimension of new media, in theory and in practice.

Content of the Minor

The minor study subject Sound in New Media (SOiN) is based on sound & music and related studies in the Department of Media, Aalto ARTS. SOiN consists of selected MA level courses, workshops and lecture series related to the sonic dimension of new media. We are looking for MA level students who have preferably completed BA level studies in media or music, or have gained corresponding competence from practical work. In addition to basic ITC skills the students are expected to have experience on audio technology. The students should also have an interest towards new media, new technologies and new forms of artistic expression.

Structure of the minor

Code	Name	Credits
Student can collect the needed 15 or 25 ECTS from these courses plus selected workshops (discussed when making personal study plan HOPS in the beginning of the academic year).		
DOM-E5074	Composing with Data Flow Programming	3
DOM-E5072	Sound Seminar	3
DOM-E5073	Sound Clinic	3-5
DOM-E5066	Introduction to Sound Design & Music	3-5
DOM-E5069	Introduction to Western Classical Music	3-5
DOM-E5065	Advanced Audio Production Work	3-10

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Textiles – Material and Structure

Basic information of the minor

Code: ARTS3056

Extent: 16–25 ECTS

Language: English

Teachers in charge: Maarit Salolainen

Administrative contact: Study Coordinator Laura Pellikka

Target group: Aalto University Master degree students, BA- and MA-students in interior design

Application procedure:

Common application period once a year: in spring. Application time is 1.–15.5.2016. Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Student nees to attach a letter of motivation (with a study plan, including a list of courses desired to the minor) and portfolio to the application. Selection criteria are earlier success in studies, motivation and possible earlier experience relating to the minor subject. Portfolio and motivation letter have to be attached to the application in eAge. More information from the teacher in charge of the minor and study coordinator Laura Pellikka (laura.pellikka@aalto.fi)

Quotas and restrictions: Max. 12 students

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

Learning outcomes

Having completed the minor the students have an understanding of the textile design process in general, tools and methods used in textile design and production technologies. The students are familiar with the use and functions of different textile materials. Through various assignments they explore and find their own way of expression.

Content

The content of the minor can be personalised and is to be discussed with teacher responsible of the minor. Lectures and hands-on assignments in a form of a coordinated sample collections, structure and material analysis.

Structure of the minor

The content of the minor can be personalised and is to be discussed with teacher responsible of the minor. Below an example of courses which can be included to the minor.

Code	Name	Credits
Core courses		
Student should take at least 4 of the following courses		
MUO-C1032	Tekstiili- ja vaatetusmateriaalien perusteet	2
MUO-C1029	Woven Fabrics – Material and Structure	4
MUO-E1019	Basic Knitting	3
MUO-E1020	Basic Printing	2
MUO-C1030	Sisustustekstiilit (Interior Textiles)*	5
*Course will be held in Finnish		
Elective courses		
These courses deepen the learning content		
MUO-C1022	Woven Fabrics Design	4
MUO-E1031	Knits and Knitwear Workshop	5

MUO-C1036	Pintasuunnittelu ja Painokangas	6
MUO-E1032	Printed Fabrics Workshop	5

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USchool

Basic information of the minor

Code: ARTS3060; SCI3072

Extent: ARTS 20 ECTS; SCI 20-25 ECTS

Language: Finnish or English

Teachers in charge: Professor Marko Nieminen, Aalto School of Science, PhD Virpi Roto, Aalto School of Arts, Design and Architecture, Professor N.N., University of Helsinki, Cognitive Science

Target group: Master's students in Computer Science and Engineering as well as CCIS and Information Networks master´s programmes at the School of Science, master's students in Collaboration and Industrial Design or New Media at the School of Arts, Design and Architecture, and master's students in Cognitive Science at the University of Helsinki.

Application procedure:

Students apply for the minor by means of a free-form application. The application period for the Usability School is in May.

The application should be submitted **by 31 May** to:
Aila Laakso aila.laakso@aalto.fi (ARTS students)
Anu Kuusela anu.kuusela@aalto.fi (SCI students)

The professors in charge of the minor select the students. The criteria used to assess the applications are: academic performance and an interest in and possible familiarity with the topic area as well as any earlier studies. A transcript of records must also be attached to the free-form application.

Quotas and restrictions: Five students from each partner school are selected for the Usability School each year.

Prerequisites: Please see Application procedure and Quotas and restrictions.

Name of the minor in other languages: Käytettävyyskoulu, användbarhetsskola

Content and structure of the minor

Usability School/USchool is a joint minor organised by the Aalto University School of Science and School of Art and Design at Aalto University and the University of Helsinki, providing the students with specialist skills in user-centred design.

The minor consists of studies in interface, usability and user-centred product development. The Usability School studies familiarise the student with working and collaborating in an interdisciplinary product design environment. The artistic and technical design competence learned at the School of Arts, Design and Architecture is supplemented by information technology and cognitive science studies at the partner schools.

USchool homepage http://uschool.aalto.fi/tietoa/usabilityschool.html

Structure of the minor

Code	Name	Credits
Compulsory courses, 8 cr		
CS-E4900	User-Centred Methods for Product and Service Design	5
MUO-E3005	User Inspired Design (This course is included in major studies for ARTS students)	5-10
Select min. 5 cr from the following		
Cog101 (HY)	Johdatus kognitiotieteeseen (Introduction to Cognitive Sceince)	6
Cog421 (HY)	Tieteellinen päättely ja selittäminen (Scientific reasoning and explanation for cognitive scientists)	3
Cog115 (HY)	Kognitiivinen psykologia I (Cognitive Psychology I)	2,5
Cog116 (HY)	Kognitiivinen psykologia II (Cognitive Psychology II)	6
Cog212 (HY)	Havaintopsykologia I (Observation Psychology I)	6
Select min. 5 cr from the following		
MUO-E3005	User Inspired Design L	5-10
MUO-E3006	Experience Driven Design	5-10
MUO-E3007	Strategic Co-Design L	5
MUO-E3008	Designing for Services	5-10
MUO-E3002	Interactive Prototyping	10
MUO-E3016	Design Ethnography L	10
MUO-E3020	Designing Interactions	10
Elective courses		
CS-E5200	Design Project	10
CS-E5210	Usability Evaluation	5
CS-E5220	User Interface Construction	5
CS-E5004	Individual Studies in Software and Service Engineering	2-10

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Visual Culture and Contemporary Art

Basic information of the minor

Code: ARTS3075

Extent: 15 ECTS

Language: English

Teacher in charge: Pia Euro

Target group: All master level students in Aalto University

Application procedure:

Application time: 1.-15.5.2016

Instructions for applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

The applicant is expected to
a) write a motivation letter (max 1 A4 sheet) which includes a description of his / her former experience, interests and also motivations for joining ViCCA minor studies and
b) to present a portfolio with a minimum of 4 work examples.
The motivation letter and portfolio should be attached to the application in the eAge system.

Quotas and restrictions: 2-4 students.

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

ViCCA minor is aimed for students who want to extend their professional understanding through methods of contemporary art, or apply practices of visual culture and contemporary art in their professional agency. The ViCCA minor gives tools to understand the role and possibilities of art in contemporary society.

Content

ViCCA minor consists of three courses and of personal tutoring. The minor students will make a personal study plan with the lecturer in charge of the minor selecting the courses from the list below. The studies will be done alongside with the students of the ViCCA major and the minor students bring their personal knowledge and viewpoint to the multidisciplinary ViCCA community.

See also: www.vicca.fi

Timing

The minor can be started every year. Students are expected to start their minor studies in the autumn term 2016, study right is valid one academic year 2016-2017.

Structure of the minor

Code	Name	Credits
Site, senses and situations		
TAI-E3100	Immersion. Experiments in spatiality and multisensority	5
TAI-E3101	Context, site and situation	5
TAI-E3102	In-between. Extensions in artistic practice	5
TAI-E3103	Mediums and Dimensions	5
TAI-E3104	Situated Urban	5
TAI-E3105	Invisible environments	5
TAI-E3106	Sites, senses and situations studio	5
TAI-E3124	Histories of Contemporary Art	5
Beings and Things		
TAI-E3017	Research as artistic practice	5
TAI-E3018	Living and non-living, a sliding matter	5
TAI-E3109	Interspecies dialoguee	5
TAI-E3112	Beings and things studio	5
TAI-E3125	Environment. Now?	5
TAI-E3126	Space, vibes and microbes	5
TAI-E3128	Grounds of Theory	5
Words and Spaces		
TAI-E3113	Authorship and agency	5
TAI-E3114	Images, tropes and narratives	5
TAI-E3115	Experimental theory workshop	5
TAI-E3116	Literary spaces in art	5
TAI-E3117	Film as culture, film as contemporary art	5
TAI-E3118	Artistic research practices	5
TAI-E3119	Words and spaces studio	5
TAI-E3123	Philosophy of art for post-contemporary artists	5

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ARTS minors only for students of ARTS

ARTS minors only for students of ARTS

In the guide, the minors offered by the School of Arts Design and Architecture (ARTS) have been classified under two headings: ARTS minors for all Aalto students and ARTS minors only for ARTS students.

On the page **ARTS minors for all Aalto students** you can find information about those ARTS minors which are primarily open for all Aalto University students. Please note that some of such minors may, however, be offered only to students of certain majors/departments.

Under **ARTS minors only for ARTS students**, you can find information about those minors which are intended only for students of ARTS.

The more specific target groups of each minor are explained in the descriptions of the minors. The descriptions also provide information on the application procedure and any restrictions regarding applicants.

ARTS minors only for students of ARTS

Minor	Extent (ECTS)	Language of Instruction
Illustrada - Illustration Minor Studies	15	Finnish
Individual Minor Subject	15-20	Finnish, Swedish, English
International Studies Minor	15-30	English
MEDes – Master of European Design (extended minor)	60 ECTS in BA and 60 ECTS in MA, total 120 ECTS	English, Swedish, German, French, Italian and Portuguese
New Directions in Design Business	15	English
PatternLab	15-25	English

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Individual Minor Subject

Basic Information

Credits: 15–25 ECTS

Teachers in charge: In Bachelor’s Programme: teacher in charge of the major, in master’s programme programme director or teacher in charge of the major

Target group: Students of Aalto ARTS

Application:

Students apply for a minor subject using an application that justifies why the minor subject is necessary in terms of his/her degree and future competence. The student's personal study plan is attached to the application. The student must name the minor subject in the application and describe his/her learning outcomes related to the minor. The teacher in charge of the major approves minor subjects for bachelor's degrees and the programme director or teacher in charge of the major for master's degrees.

For the most part, minors are still selected from the minor subject modules confirmed at Aalto University, completed in an international exchange or as JOO studies in another Finnish university.

Name: Henkilökohtainen sivuaine, Personligt biämne, Individual Minor Subject

Objectives and content of the minor subject

An individual minor subject is intended for students who study in a Bachelor's Programme in Arts, Design and Architecture according to the new degree requirements that take effect on 1 August 2014.

An individual minor subject is a study module that is confirmed for a student when the student needs competence to complement the major subject or programme studies that cannot be obtained by studying the minor subjects confirmed in the Aalto University curriculum or in minor subjects arranged at other universities. An individual minor subject must always be a target-oriented module that can be named. The minor subject cannot be used to compile a group of random courses into a minor. The minor subject may not have the same name as the student's major subject.

An individual minor subject can also be confirmed for a student during or after the bachelor's degree transition period if a minor subject that becomes compulsory in the new degree requirements would otherwise slow the student's studies.

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International Studies Minor

Basic Information

Credits: 15–30 ECTS

Teachers in charge:

Bachelor’s degree: Teachers in charge of the majors,
Master’s degree: Directors of the degree programmes

Target group: Students of the School of Arts Design and Architecture

Application:

To apply for a minor, students file an application describing the contents of the planned studies, and provide a personal study plan (HOPS) as an appendix to the application. The minors of the bachelor’s degree are approved by the person in charge of the major and those of the master's degree by the director of degree programme or the person in charge of the major.

Description of Content

International studies minor consists of courses, which are relevant to student’s degree at Aalto University and which are completed during the student exchange abroad. International study minor is a strong and visible unit of international dimension in a student’s degree.

In addition to the professional content of the minor, module aims to produce knowledge and practical skills in languages and intercultural competence.

International studies minor consists of 15-30 credits and it can be a minor either in Bachelor's or Master's degree. International studies minor may include host country language and cultural studies. Terms and conditions of Aalto University student exchange applies.

Minimum requirement to gain the International Studies minor status:

- Credits: 15–30 ECTS
- Minimum requirement for studies completed during the exchange: 10 credits
- Maximum requirement for language and cultural studies completed in at Aalto University 5 credits
- Traineeship abroad can be considered a way of completing the module (max 5 credits)

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MEDes - Master of European Design

Basic information of the minor

Code: ARTS3080 (BA), ARTS3081 (MA)

Extent: 60 ECTS in BA and 60 ECTS in MA, total 120 ECTS

Language: English, Swedish, German, French, Italian and Portugese

Teacher/professor in charge: Professor Peter McGrory

Administrative contact: Study Coordinator Aila Laakso

Target group: BA students at the Department of Design

Application procedure:

The applicants must be first year bachelor students (in very specific cases also second year students can be considered). Application deadline is by the end of January 2017 and the application material should include a study transcript and a letter of motivation and a mini-portfolio if possible (it is understood that students after only 4 months of studies are not able to present a wide portfolio).

Applicants should have a good command of some of the languages of the programme. Application process includes an interview. The head of the program has responsibility of the selection procedure.

The acceptance to the MEDes programme concerns both BA and MA studies. The students do not have to apply again in the MA level. However, the student is not allowed to start the MA studies until the BA degree is completed.

Coordinator of the minor at Aalto ARTS: Aila Laakso

Quotas and restrictions: Annually 2-6 Bachelor's student from the Department of Design are selected to the programme.

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

The Master of European Design (MEDes) is a study programme offered by a network of seven leading European design schools. MEDes in Finland is a minor studies programme for the students of the Department of Design that spans over the whole study time.

During the five years of studies (three years of Bachelor's studies and two years of Master's studies), MEDes student lives and studies in three different schools and countries. In the first and second year, students study at their home institution. The third year of Bachelor's studies is the first exchange year abroad, which results in a Bachelor's thesis prepared at the partner institution, and in close contact with the examiners for the Bachelor's degree at the home institution. The second year abroad is the first year of the Master's degree. After the two years abroad, the students return to their home institution in the fifth year to reflect upon and to synthesise the diverse experiences and to work on their final Master's project and/or thesis. One of the MEDes program's rules is that the studies must end in the same university they started.

MEDes offers to its students means to gain insight into different design approaches, ability to adapt to various systems whilst remaining critical and testing own thoughts and methods in these multifaceted working environments. Spending altogether two years abroad during the Bachelor's studies and Master's studies and studying in three different educational systems helps to build confidence, language competencies are extended and professional and social skills are improved.

Important part of the MEDes activities is the network itself. MEDes students, professors, coordinators and alumni gather together once a year for an annual workshop in one of the participating schools. MEDes gives students both professional and social network which carries over the study years.

Structure of the minor

In Aalto University MEDes programme is available as an extended minor. This means that the extent of the minor is 60 ECTS in both Bachelor's and Master's degree, 120 ECTS in total. In Bachelor's degree the MEDes studies are placed as minor studies and elective studies (total max. 40 ECTS) and also in student's major studies (20 ECTS) according to student's PSP (Personal study plan). In Master's degree MEDes studies are placed as elective studies (30 ECTS) and in advanced major studies (the rest 30 ECTS) according to student's PSP.

During their stay abroad, the students follow the curriculum of the particular partner universities. Students will follow a learning agreement which is based on the personal study planning discussions, and approved by both of the institutions.

MEDes – Master of European Design; 60 ECTS in bachelor's studies and 60 ECTS in master's studies at one of the following partner universities

- GSA The Glasgow School of Art, Department of Product Design, Glasgow, UK
- LES ATELIERS École nationale supérieure de creation industrielle, Paris, France
- POLIMI Politecnico di Milano, Milano, Italy
- KISD Köln International School of Design, Cologne, Germany
- KONSTFACK Univeristy College of Arts, Crafts and Design, Stockholm, Sweden

- AVEIRO University of Aveiro, Aveiro, Portugal

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PatternLab

Basic information of the minor

Code: ARTS3082

Extent: 15-25 credits, IV-V period (2017) – I - III period (2018)

Language: English

Responsible teacher: adjunct professor Maarit Salolainen

Target group: Students from the FCD MA-programme, other Aalto ARTS MA-students.

Application procedure: Common application period once a year in autumn. Application time and instructions will be announced later.

Student needs to include a portfolio as well as a letter of motivation to the application. In addition a study plan is required, including a list of courses to be included in the minor. Selection criteria are quality of the portfolio, motivation and earlier success in studies. Participation requires commitment to this year-long project. The portfolio, motivation letter and study plan are to be attached to the application in eAge.

For all students interested in applying to the PatternLab Minor:

Welcome to the info session on Tuesday 27.9.2016 12-13 in Room 6088.

Adjunct Professor Maarit Salolainen and the PatternLab17 students will be telling about the project and answering your questions.

Please see also http://patternlab.aalto.fi for more information

Additional information on the minor from the professor in charge of the minor as well as from the study coordinator Elina Turunen (elina.turunen@aalto.fi).

Quotas and restrictions: Max. 12 Aalto ARTS students

Prerequisites: Please see application procedure and quotas and restrictions.

Content and structure of the minor

Learning outcomes

Students are able to design surface designs with different methods and for various purposes. Students understand how freelance designers work in an international environment within the

context of surface design. Students are familiar with the promoting and sales processes of surface design collections. They are familiar with repeats, making and coordinating colourways and collections and are able to create a collection of surface designs according to design brief.

Content: During this one-year learning-by-doing design students design a collection of surface designs according joint themes and learn how to market and sell the collection.

- Creating joint collection and marketing concept, project planning and scheduling, project funding, marketing, sales and PR, pricing and agreements.
- Designing individual collection of surface designs
- Customer meetings in Finland and in other Scandinavia
- Participating as a team in international trade fairs

Additional information: The Surface Design-course is a prerequisite for the PatternLab -course. PatternLab website: http://patternlab.aalto.fi

Structure of the minor

The content of the minor 15-25 credits is to be discussed with the teacher responsible of the minor.

Code	Name	Credits
MUO-E1027	Surface Design	10
MUO-E1009	PatternLab	10
MUO-E1017	Projects	5

ARTS individual courses for all Aalto students

ARTS individual courses for all Aalto students

Courses for which the study right can be applied for

Department of Art

Department of Art

See Instructions for applying.

Department of Design

Department of Design

See Instructions for applying.

Department of Film, Television and Scenography

Department of Film, Television and Scenography

See Instructions for applying.

Department of Media

Department of Media

See Instructions for applying.

Doctoral students can apply for a study right for any of the ARTS courses (even if the course is not listed here).

Contact information

School of Arts, Design and Architecture

Planning Officer Laura Pellikka
laura.pellikka@aalto.fi
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BIZ minors for students from other Aalto schools

In the guide, the minors offered by the School of Business (BIZ) have been classified under two headings: BIZ minors for all Aalto students and BIZ minors only for students of BIZ.

On the page **BIZ minors for all Aalto students** you can find information on those BIZ minors which all Aalto University students can apply to. The more specific target groups of each minor are explained in the descriptions of the minors, for example some minors may be offered only to Master's students. The descriptions also provide information on the application procedure and any restrictions regarding applicants. Notice also that a study right to a certain minor does not guarantee a right to attend any of the courses of that minor, but courses may have their own restrictions, quotas or prerequisites, which can be found from the course description in WebOodi.

For additional information on application see Instructions for applying. Application to some of the BIZ minors is open only in one of the internal mobility application periods, either in autumn or in spring. In addition, some BIZ minors have their own application procedure, so please read the instructions carefully before applying.

Under **BIZ minors only for students of BIZ**, you can find information on all those minors which are offered for students of the School of Business.

On the page **BIZ individual courses for all Aalto students**, you can find listings of courses for which it is possible to apply a study right for.

BIZ minors for all Aalto students

Minors offered by the School of Business are divided into intermediate level minors and advanced level minors. Minor in Quantitative Methods can be completed either as intermediate level or

advanced level. Advanced level minors are targeted only for Master’s students. Intermediate level minors can be applied to by both Master’s and Bachelor’s students, according to the requirements of their own school.

Notice that those (intermediate level) minors, which language of instruction is Finnish, require sufficient proficiency in Finnish. More information on minors offered in Finnish you can find on the Finnish pages of the Minors Guide.

Minor	Extent (ECTS)	Language of instruction
Intermediate level minors		
Accounting	24	Finnish
Business Law	24	Finnish
Business Technology	24	Finnish
Economics	24	Finnish
Finance	24	English (some courses in Finnish)
Fundamentals of Business Knowledge	24	Finnish
Information Technology Programme	24	English
International Business (Mikkeli campus)	24	English
Management	24	Finnish
Marketing	24	Finnish
Intermediate / advanced level minor		
Quantitative Methods	24	Finnish / English (some courses in Finnish)
Advanced level minors		
Corporate Communication	24	English (some courses in Finnish)
Information and Service Management	24	English
Management and International Business	24	English
Selling and Sales Management	24	English (some courses in Finnish)

Aalto Service Minor

Code: to be announced later

Extent: 20 - 25

Language: English

Teacher in charge: Matti Rossi

Target group: All Aalto master's level students

Application procedure: Detailed description of the application procedure can be found on the minor webpages at http://asm.aalto.fi The motivation letter and study plan should be sent in pdf format to: asm@aalto.fi

Quotas and restrictions: Aalto Service Minor does not have quotas or intake restrictions in place.

Prerequisites: None for the minor. Separate courses may have prerequisites that the students should take into account in their personal study plans.

Name of the minor in other languages: n/a

Content and structure of the minor

Aalto Service Minor is offered to all Aalto master's students who want to get a broad, multidisciplinary general knowledge on services. After completing the minor, the student has a general knowledge of how to manage, operate, design, and develop services and service business successfully. The student has acquired a service-oriented mindset and experience of working in an interdisciplinary manner with students from different disciplines.

Aalto Service Minor offers the student the opportunity to study a mix of courses in service operations and management, design and development of services, service business and marketing, and ICT-enabled and information rich services – or focusing more on one or two of these aspects.

Structure of the minor

Course code	Minor	Extent (ECTS)
Mandatory Course		
TU-E2000	Aalto Introduction to Services	3-6cr
Optional Courses		
Pick and choose enough to fulfill minor requirements.		
Choose at least two courses from the following core courses.		
TU-E2010	Industrial Service Operations	3-6 cr
MUO-E3008	Designing For Services	5cr or 10cr
CSE-E5800	User-Centered Methods for Product and Service Design	5cr
CSE-E4660	ICT Enabled Service Business and Innovation	5 cr
37E00100	Information Economy	6 cr
35E08000	Service Business Models	6 cr
If necessary, choose from the courses listed below to reach total credit requirement. The courses listed below can be included in the minor without separate approval (NOTE: acceptance to Aalto Service Minor does not guarantee that you will be accepted to these courses).		
37E01500	Project Management and Consulting Practice	6 cr
37E44000	Critical Issues in Information Systems Research 1)	6 cr
TU-E2110	Innovation in Operations and Services 2)	3-5 cr

TU-E3120	Human Resources in Service Operations	5 cr
23C550	Services Marketing	6 cr

1) Course content varies
2) Course not lectured in spring 2017.

Corporate Communication

Basic information of the minor

Code: BIZ40300

Extent: 24 ECTS

Language: English (some courses in Finnish)

Teacher in charge: Leena Louhiala-Salminen

Target group: Master's students

Application procedure: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Quotas and restrictions: Quota 4 students

Content and structure of the minor

Corporate Communication minor is designed to give students a trans-disciplinary understanding of the fields of corporate communication and media management. In CC studies, corporate communication is viewed both as a business function and, at the same time, as social interaction. Throughout the courses, we highlight the impact of the globalized environment on communication practice, management and leadership.

CC Minor provides students with knowledge of the strategic role of communication in contemporary organizations. The CC courses offer professional and academic competences needed in managing international corporate communications, engaging in corporate strategy work, and managing internal and external stakeholder relations. In particular, the CC Minor develops competences within such specific areas as organizational communication, investor relations, media rhetoric and crisis communication. Throughout all course work and problem-based learning activities we practise the skills needed for a variety of multicultural and multilingual encounters.

A student completing the Corporate Communication Minor will have a thorough understanding of

- the strategic role of corporate communication for business operations;
- the specialist areas of corporate communication, e.g. organizational communication and leadership, investor relations, issues management, change and crisis communication; and
- communication as social interaction.

In addition, s/he will be able to

- manage the stakeholder relations involved in the various specialist areas of corporate communication;
- analyse, plan and conduct corporate strategy work from the perspective of communication; and
- argue convincingly and demonstrate excellent communication skills.

Structure of the minor

Code	Name	Credits
Mandatory course		
75E00100	Managing Corporate Communication	6
Elective courses		

Choose three courses of the following:

71E00200	Communication in Strategy Work	6
75E15000	Investor Relations	6
75E16000	Issues Management	6
75E18000	Organizational Communication and Leadership	6
75E20000	Corporate Communication Special Topics (Introduction to Visual and Multimodal Communication)	6
75E21000	Corporate Communication in Global Contexts	6

One course of the electives can be a C-level course:

71C00400	Työyhteisöviestintä	6
71C03000	Digitaalinen viestintä ja media	6
71C07000	Muutosviestintä	6
71C08000	Strategic stakeholder relations	6

Information and Service Management

Basic information of the minor

Code: BIZ40700

Extent: 24 ECTS

Language: English

Teachers in charge: Merja Halme, Matti Rossi, Markku Kuula

Target group: Master's students

Application procedure: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Quotas and restrictions: Quota 2 students

Content and structure of the minor

Information and Service Management (ISM) refers to the creative use of information and technology in decision making, in managing business processes and networks, and in developing new products and services. While ISM gives an understanding of different business functions and their interdependence relevant to managers, it also provides methods and skills for economic analysis required in many other fields of undergraduate and graduate studies.

Topics covered by the minor studies in Information and Service Management include:

- decision analysis and negotiation processes;
- development of information systems and associated business processes and services;
- logistics and supply chain management: sourcing, production and distribution of goods and services;
- management of technological innovation; and
- mathematical methods and statistical analysis.

Minor studies in Information and Service Management consist of three focus areas: Business Analytics, Information Systems Science and Logistics and Service Management. The focus of *Business Analytics* is on increasingly important skills to manage and analyse the rapidly growing supply of information. The focus of *Information Systems Science* is on the know-how necessary to efficiently manage and develop business processes using information systems and networks. The focus of *Logistics and Service Management* is on providing students with the capabilities to manage and develop companies' production, distribution, supply, purchasing and service operations.

Minor studies in ISM typically consist of four E-level courses totalling 24 cr. If a student has no prior studies in ISM subjects, one or two C-level courses can be included in the minor. The possible C-level courses are listed in the course lists below. As an alternative to the Master's level minor studies, the student may choose a minor from the Bachelor's level (Business Technology, BIZ30300).

Structure of the minor

Code	Name	Credits
Business Analytics		

Choose 4 courses from the following:

27E02000	Models in Marketing	6
27E20100	Database Marketing	6
30E00400	Simulation	6
30E02000	Business Decisions 2	6
30E03000	Data Science for Business I	6
35E00800	Intellectual Property Rights	6
57E00500	Business Intelligence	6
27E01000	Decision Making and Choice Behavior	6
30E00800	Time Series Analysis	6
30E00500	Quantitative Empirical Research	6
TU-22.E2000	Aalto Introduction to Services P	6

You can also choose max 2 from the following C-level courses:

27C01000	Tools for Business Decisions 1	6
30C02000	Negotiation Analytics	6
30C00200	Econometrics	6
30C00350	Mathematics II	6

Information Systems Science

Choose 4 courses from the following:

37E00100	Information Economy	6
37E00200	Strategic Information Technology Management	6
37E00300	ICT Enabled Business Process Development	6
37E01000	Current Topics in Information Systems Science	6
37E01500	Project Management and Consulting Practice	6
37E44000	Critical Issues in Information Systems Research	6
57E00500	Business Intelligence	6
TU-22.E2000	Aalto Introduction to Services P	6

You can also choose max 2 from the following C-level courses:

37C00100	Management Information Systems	6
37C00200	Information Systems Development	6
57C99904	Capstone: Enterprise Applications	6

Logistics and Service Management

Choose 4 courses from the following:

35E00100	Service Operations and Strategy	6
35E00300	Product and Inventory Management	6
35E00400	Coordination of Supply Chains	6
35E00500	Quality Leadership	6
35E00700	Packaging and Warehousing Technologies, book exam	6

57E00500	Business Intelligence	6
TU-22.E2000	Aalto Introduction to Services P	6

You can also choose max 2 from the following C-level courses:

35C00100	Distribution and Logistics Services	6
35C00200	Purchasing and Supply Management	6

Information Technology Programme

Basic information of the minor

Code: BIZ30004E

Extent: 24 ECTS

Language: English

Application procedure: itpaalto.fi

Quotas and restrictions: Minimum 60 ECTS of Bachelor's studies must be completed

Content and structure of the minor

Information Technology Programme (ITP) is a full time academic summer programme organised in close cooperation with companies in the fields of information technology based businesses and digital design. The purpose of ITP is to provide students with a strong applied understanding of current information technologies. The programme provides concepts and approaches that enable students with diverse backgrounds to operate effectively in the global business environment now and in the future. Students gain valuable real life project experience in the business project course executed during the programme.

All courses are run in the form of intensive modules. A normal one semester university course is compressed to three weeks of full time study. Each course includes 42 contact hours (3.5 hours a day, four days a week) excluding group work and individual assignments. Approximate workload for ITP is 6-9 hours a day throughout the summer. In addition to theoretical studies in ITP courses all students complete a business project for cooperating companies under the programme supervision.

Students need to apply for the programme. More information available on the programme website itpaalto.fi.

Structure of the minor

Choose one of the following subprogrammes Information & Service Business, Strategy & Experience Design or Digital & Interactive Entertainment

Code	Name	Credits
Information & Service Business		

47C52000	Achieving Strategic Advantage Through Distributed Technologies	6
47C58200	Managing Software and Service Business	6
47C58600	Current Topics in Information & Service Business	6
47C48000	ITP Business Project	6

Strategy & Experience Design

47C58300	Strategic Design	6
47C58400	User Experience Design	6
47C58500	Prototyping and Implementation	6
47C48000	ITP Business Project	6

Digital & Interactive Entertainment

47C59000	Digital Marketing Strategies	6
47C59100	Monetization Business Models	6
47C59200	Web and Mobile Analytics	6
47C48000	ITP Business Project	6

International Business (Mikkeli campus)

Basic information of the minor

Code: BIZM0310

Extent: 24 ECTS

Language: English

Teacher in charge: Joan Lofgren

Application procedure: Continuous application, own application procedure https://into.aalto.fi/display/enbscba/Minor+in+International+Business

Quotas and restrictions: Mandatory attendance apart from certain exceptions

Content and structure of the minor

Minor in International Business is offered at the Aalto University School of Business Mikkeli Campus. Minor in International Business prepares students to meet the demands of business in the global marketplace and advanced studies. Offering the minor entirely in English, the curriculum facilitates individual and collaborative learning in a multicultural context, while ensuring basic literacy in the field of international business. Upon completion of the minor, students will have the following competences - they will be able to:

- understand the key theories and concepts of international business and link them to their major fields of study and expertise;

- analyse the political, legal, economic, and cultural environment of international companies and other organizations;
- work effectively in international business, for example: recognizing international business opportunities, managing internationalization and international market development, and dealing with diverse cultural contexts; and
- engage in an international learning community by developing presentation, communication and teamwork skills.

Minor in International Business consists of

- one basic course (6 ECTS) in the field of business (completed in Helsinki or Mikkeli)
- three elective courses (18 ECTS) offered by the International Business programme (completed in Mikkeli)

More information on the minor in International Business, application procedure and structure of studies is available on Into at https://into.aalto.fi/display/enbscba/Minor+in+International+Business.

International Design Business Management

Basic information of the minor

Code: BIZ40006E (BIZ) / IDBM.a (ARTS) / TU3007 (technology)

Extent: 25 ECTS

Language: English

Teachers in charge: Mikko Koria (BIZ), Peter McGrory (ARTS), Matti Vartiainen & Kalevi Ekman (SCI)

Target group: Master's students

Application procedure:

The IDBM minor programme is available for all master level students of Aalto through separate application. Approved study plan has to be attached to the application. Deadline for the applications is yearly by May 15th. For more information, please visit http://idbm.aalto.fi

Content and structure of the minor

IDBM is a multidisciplinary programme organised in collaboration by the School of Business, School of Arts, Design and Architecture and School of Science. The minor programme builds on prior studies in the areas of business, design and technology by enabling and encouraging students to further develop and integrate their knowledge in multidisciplinary teams. The aim of the minor programme is to provide participants with the competence and capability to successfully undertake creative teamwork, concept development, business modelling and project management through industry collaboration and a tailor made course in international design business management.

For more information visit the programme website www.idbm.aalto.fi.

Structure of the minor (BIZ & ARTS)

Code	Name	Credits
Compulsory industry project		
26E04800	IDBM Industry Project (Business)	5
MUO-E9002	IDBM Industry Project (Design)	5
TU-E5010	IDBM Industry Project (Technology)	5
Compulsory courses		
26E04700	Creative Teamwork	5
Select one course from the list below (5 ECTS)		
26E04450	Design Business Management 1)	5
26E04350	Business Model Design 2)	5
Kon-41.4003	Interdisciplinary Product Development	5
TU-E5001	Innovation Management 3)	5
MUO-E9000	Creative Leadership	5
MUO-E9005	Integrated Design Management	5

1) Replaces course 26E04400 International Design Business Management 5 cr

2) Replaces course 26E4300 Business Modelling and Management 5 cr

3) Replaces course TU-E5000 Innovation and Project Management 5 cr

In special cases the students can apply for different minor studies structure. Any changes in the minor studies structure need to be approved in advance.

Management and International Business

Basic information of the minor

Code: BIZ40200

Extent: 24 ECTS

Language: English

Teacher in charge: Saija Katila

Target group: Master's students

Application procedure: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Quotas and restrictions: Quota 1 student

Content and structure of the minor

The aim of the minor in Management and International Business is to focus on working and interacting with diverse people in the various contexts of the global economy, and it offers

competences that enable graduates to respond to strategic and organizational challenges in a creative, responsible and interdisciplinary manner.

When planning minor studies, please take into consideration that some of the courses may have defined limitations as to course sizes and priorities in participation. Information required is provided in the course descriptions.

Compulsory course is 26E03600 Introduction to Management and International Business (book exam) that has to be completed before other studies.

Structure of the minor

Code	Name	Credits
Mandatory course		
26E03600	Introduction to Management and International Business, book exam	6
Elective courses		
21E00012	Gender and Diversity at Work	6
21E00030	Strategy Work	6
21E00031	Innovation, Strategic Resilience and Renewal	6
21E00032	Innovation Processes in Transition	6
21E00033	Strategic Change 1)	6
21E00034	Strategy Process	6
21E00051	Strategic Human Resource Management	6
21E10000	How to Change the World: Innovating toward Sustainability 2)	6
21E11001	Dialogues on Corporate Responsibility in Global Economy 3)	6
21E16000	Sustainable Business and Consumption	6
26E00800	Global Marketing Management	6
26E00250	Doing Business in China 4)	6
26E02500	Doing Business in Russia	6
26E03100	Driving Global Businesses	6
26E03200	Managing in a Global Context 5)	6
26E03300	Operating in Different Cultural and Institutional Contexts	6
26E03400	People Management in Multinational Organizations	6
51E00100	Business Ethics	6
21E01050	Management and Strategy Making, book exam	6
21E03050	Inside Work Cultures, book exam	6

21E06050	Responsibility Management, book exam	6
26E05000	Game Industry: Born Global, Innovative and Digital	6
21E00035	Management and Strategy Book Club I	3
21E00036	Management and startegy Book Club II	3

You can also choose courses from the B.Sc. Management specialisation area (in Finnish).

1) Replaces course 21E90000 Managing Innovation and Change; Prerequisite: 21E00030 Strategy Work

2) Prerequisite: 21E16000 Sustainable Business and Consumption

3) Replaces course 21E11000 Corporate Responsibility in Global Economy

4) Replaces course 26E00200 Rising China - Business and State

5) Prerequisite: 26E03100 Driving Global Businesses

Quantitative Methods

Basic information of the minor

Code: BIZ30800 / BIZ41305

Extent: 24 ECTS

Language: English (some courses in Finnish)

Teachers in charge: Tomi Seppälä, Timo Kuosmanen

Application procedure: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Quotas and restrictions: Quota 2 students

Content and structure of the minor

Nowadays large amounts of data are being automatically created through current IT technologies and database systems. As a result, the demand for specialists who are able to manage, analyse and model the rapidly growing supply of information has enormously increased over the last years and will continue to do so in the future. A minor in Quantitative Methods provides both theoretical and practical knowledge of mathematical and statistical tools that can be used to analyse data to support managerial decision making and economic policy. The aim is to effectively use modern managerial tools, such as quantitative models and information technology, in solving practical business problems. The main themes include statistical methods, simulation, optimization, management decision making, risk management, and econometric methods.

Structure of the minor

Minor in Quantitative Methods can be completed either as intermediate level (BIZ30800) or as advanced level (BIZ41305). Advanced level minor is targeted to Master's level students. If you complete the minor as intermediate level, you can only choose intermediate level courses. If you complete the minor as advanced level, you can freely choose courses from both intermediate level and advanced level offerings.

Choose four of the following courses:

Code	Name	Credits
Intermediate level courses		
27C01000	Business Decisions 1	6
30C00100	Statistical Analysis	6
or		
30C00600	Tilastotieteen jatkokurssi (in Finnish)	6
30C00200	Econometrics	6
30C00350	Mathematics II *)	6
30C00750	Noin fifty-sixty? Kurssi epävarmuuden käsitteistä, käsittelystä ja käsittämättömyydestä (in Finnish) 1)	6
30C02000	Negotiation Analytics	6
	Quantitative Methods studies at another university or another Aalto School **)	6

1) Not lectured 2016-2017

*) Replaces course 30C00300 Mathematical Methods for Economists

**) Must be agreed in advance with the coordinators

Advanced level courses
The following courses you can choose only if you complete the minor as advanced level (BIZ41305).

30E00300	Productivity and Efficiency Analysis 1)	6
30E00400	Simulation	6
30E00500	Quantitative Empirical Research	6
30E00800	Time Series Analysis	6
30E02000	Business Decisions 2	6
30E03000	Data Science for Business	6
90E09000	Current Topics in Quantitative Methods 1)	6
90L56503	Behavioral Decision Making 1)	6

27E01000	Decision Making and Choice Behavior	6
	Quantitative Methods studies at another university or another Aalto School **)	6

1) Not lectured 2016-2017

**) Must be approved by the coordinators in advance

Selling and Sales Management

Basic information of the minor

Code: BIZ40902

Extent: 24 ECTS

Language: English (some courses in Finnish)

Teacher in charge: Professor Paul Viio

Target group: Master's students

Application procedure: Open for applications only during Spring application period. Intructions on applying: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/minor.html

Quotas and restrictions: Open for applications only during Spring application period

Content and structure of the minor

A minor in Selling and Sales Management provides both theoretical and practical tools that can be used to solve the most fundamental questions in business i.e. how to improve revenue and profitability. The minor provides students with useful and necessary skills in areas such as trade, negotiations, bidding and growth and profitability seeking management.

Structure of the minor

Code	Name	Credits
Mandatory course		
TU-E4080	Managing Innovative Sales 1)	3

1) Teaching in Otaniemi

Elective courses		
TU-E4090	Managing Innovative Sales, exercises 1)	3

23C72050	Customer Experience Management 3)	6
23C77051	Myynnin verkkokurssi (in Finnish) 4)	6
23E47000	Digital Marketing	6
23E23025	Personal Selling 2)	6
23C23067	Business Sales and Purchasing Management 2)	3
Vie-98.1224	Neuvottelutaito L (in Finnish)	2
	A course at another Department or School *)	6

1) Teaching in Otaniemi

2) Joint-course with Hanken

3) Replaces course 23C72000 Customer Relationship Management

4)Replaces earlier courses 23C77050 Myynnin peruskurssi, 23C77000 Sales, selling and sales work and TU-C8250 (Sales and Marketing)

*) Must be approved by the minor studies coordinator (please contact the study coordinator of the Department of Marketing Tatiana Penttinen).

BIZ minors only for students of BIZ

BIZ minors only for students of BIZ

Minors of Aalto University School of Business offered for its own students can be found from the School of Business Study Guide at studyguides.aalto.fi/biz.

BIZ minors only for students of BIZ

Minor	Extent (ECTS)	Language of instruction
Minors in Bachelor’s Degree		
Accounting	24	Finnish
Business Law	24	Finnish
Business Technology	24	Finnish
Communication	24	Finnish
Economics	24	Finnish
Finance	24	Finnish
Information Technology Programme	24	English
International Business (Mikkeli campus)	24	English
Management	24	Finnish
Marketing	24	Finnish

Multilingual Business Communication	24	Several languages
Quantitative Methods	24	Finnish (some courses in English)
Minors in Master’s Degree		
Accounting	24	English (some courses in Finnish)
Business Law	24	English (some courses in Finnish)
Consumer Research	24	English
Corporate Communication	24	English (some courses in Finnish)
Creative Sustainability	24	English
Economics	24	English (some courses in Finnish)
Entrepreneurship	24	English
Fashion Marketing	24	English
Finance	24	English
Information and Service Management	24	English
Information Technology Programme	24	English
International Design Business Management	24	English
Management and International Business	24	English
Marketing	24	English (some courses in Finnish)
Multilingual Business Communication	24	Several languages
New Directions in Design Business	24	English
Quantitative Methods	24	English (some courses in Finnish)
Selling and Sales Management	24	English (some courses in Finnish)
Strategic Marketing	24	English (some courses in Finnish)

BIZ individual courses for all Aalto students

BIZ individual courses for all Aalto students

You can apply for a study right for the School of Business courses listed on this site. It is not possible to apply for a study right for courses that are not listed on this site. Doctoral students can apply for a study right for any of the BIZ courses (even if the course is not listed here).

Please find instructions on applying here: http://studyguides.aalto.fi/minors-guide/2016/en/instructions-for-applying/individual-courses.html

Before applying for the study right, be sure to see WebOodi for preliminary requirements set for the course!

School of Business offers students from other Aalto schools also a lot of courses that you can complete without having to separately apply for a study right. These Aalto cross-school courses are listed here: http://studyguides.aalto.fi/minors-guide/2016/en/aalto-cross-school-courses.html

IV

Johtamisen laitos / Department of Management Studies

21A00110 Johtamisen perusteet, 6 ECTS, kiintiö / quota / kvot: 2
21E00012 Gender and Diversity at Work, 6 ECTS, kiintiö / quota / kvot: 5
21E03050 Inside Work Cultures, Book exam, 6 ECTS, kiintiö / quota / kvot: 5

Laskentatoimen laitos / Department of Accounting

22C00200 Johdon laskentatoimi I, 6 ECTS, kiintiö / quota / kvot: 17
22C00400 Tuloslaskenta, 6 ECTS, kiintiö / quota / kvot: 19

Markkinoinnin laitos / Department of Marketing

23C630 Capstone-course: Product and Brand Management, 6 ECTS, kiintiö / quota / kvot: 9

Taloustieteen laitos / Department of Economics

31E00600 Open Economy Macroeconomics, 6 ECTS, kiintiö / quota / kvot: 10
31E00700 Labor Economics, 6 ECTS, kiintiö / quota / kvot: 10

Tieto- ja palvelutalouden laitos / Department of Information and Service Economy

35A00310 Tuotantotalouden perusteet, 6 ECTS, kiintiö / quota / kvot: 2
37C00200 Information Systems Development, 6 ECTS, kiintiö / quota / kvot: 3
57C99904 Capstone: Enterprise Applications, 6 ECTS, kiintiö / quota / kvot: 14
35E00500 Quality Leadership, 6 ECTS, kiintiö / quota / kvot: 3
37E00100 Information Economy, 6 ECTS, kiintiö / quota / kvot: 3
35E00700 Packaging and Warehousing Technologies (book exam), 6 ECTS, kiintiö / quota / kvot: 3

IV - V

Tieto- ja palvelutalouden laitos / Department of Information and Service Economy

30C00300 Mathematical Methods for Economists, 6 ECTS, kiintiö / quota / kvot: 3
30E00800 Time Series Analysis, 6 ECTS, kiintiö / quota / kvot: 5

V

Johtamisen laitos / Department of Management Studies

21A00410 Yritysvastuu ja -etiikka, 6 ECTS kiintiö / quota / kvot: 29
26E03300 Operating in Different Cultural and Institutional Contexts, 6 ECTS kiintiö / quota / kvot: 5
26E02500 Doing Business in Russia, 6 ECTS kiintiö / quota / kvot: 2

Taloustieteen laitos / Department of Economics

31C00800 Personnel Economics, 6 ECTS kiintiö / quota / kvot: 10
31C00900 Raha- ja pankkiteoria, 6 ECTS kiintiö / quota / kvot: 10
31C01300 Energy and Environmental Economics, 6 ECTS kiintiö / quota / kvot: 10
31E03000 Investment Decisions in Emerging Markets, 6 ECTS kiintiö / quota / kvot: 10

Tieto- ja palvelutalouden laitos / Department of Information and Service Economy

30A02000 Tilastotieteen perusteet, 6 ECTS kiintiö / quota / kvot: 3
37C00450 Programming II, 6 ECTS kiintiö / quota / kvot: 3
30E00300 Productivity and Efficiency Analysis, 6 ECTS kiintiö / quota / kvot: 3
35E00700 Packaging and Warehousing Technologies (book exam), 6 ECTS kiintiö / quota / kvot: 3

Contact information

School of Business

Planning Officer Aino Salminen
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tel. 050 413 6414

CHEM minors for all Aalto students

In the guide, the CHEM minors have been classified under two headings: CHEM minors for all Aalto students and CHEM minors only for CHEM students.

On the page **CHEM minors for all Aalto students** you can find information about those CHEM minors which are primarily open for all Aalto University students. Please note that some of such minors may, however, be offered only to students of certain majors/departments.

Under **CHEM minors only for CHEM students**, you can find information about those minors which are intended only for students of CHEM.

The more specific target groups of each minor are explained in the descriptions of the minors. The descriptions also provide information on the application procedure and any restrictions regarding applicants.

CHEM minors for all Aalto students

Minor	Extent (ECTS)	Language of instruction
Chemistry	20 - 25	Finnish

Industrial process technology	20 - 25	Finnish
Sustainable processing of natural recourses	20 - 25	Finnish
Biomass refining	20 - 25	English
Biotechnology	20 - 25	English
Chemical engineering	20 - 25	English
Chemistry	20 - 25	English
Fiber and polymer engineering	20 - 25	English
Functional materials	20 - 25	English
Sustainable metals processing	20 - 25	English

CHEMARTS

Code: CHEM3029

Extent: 15 - 20 cr

Language: English

Professor in charge: Tapani Vuorinen

Target group: Bachelor and Master's degree students

Application procedure: Students will be selected in order of registration in WebOodi to course MUO-C1044 CHEMARTS Summer School. If there are more applicants than can be accepted, applicants will be asked to send a motivation letter.

Quotas and restrictions: 30 students (10 CHEM, 10 ARTS, 10 from other Aalto University Schools)

Prerequisites: No

Content and structure of the minor

CHEMARTS is an interdisciplinary minor program, organized jointly by the Aalto School of Chemical Technology (CHEM) and the Aalto School of Arts, Design and Architecture (ARTS).

The main objectives of the CHEMARTS minor are to inspire students with varying backgrounds to explore biomaterials together, and to create new concepts for the sustainable use of cellulose and other wood-based materials. The minor combines scientific materials research with creative practices and design thinking. The approach is experimental and student-driven. During the pilot year 2016 - 2017 the minor consists of two compulsory courses.

http://chemarts.aalto.fi

https://www.facebook.com/chemarts.aalto

Learning outcomes

After completing CHEMARTS minor students understand the basics of scientific materials research related to biomaterials. They are familiar with the most common working methods used in materials research and design practice. Students work mainly in teams and experience the strengths and challenges of interdisciplinary collaboration, and they understand how to apply the knowledge to their forthcoming projects. Students know how to follow the latest developments of biomaterials related research and business.

Structure of the minor

The minor starts during the spring semester with 'Design Meets Biomaterials' course, followed by the CHEMARTS Summer School, either the same or the following year. Depending on student's project, there is an option to continue their work during the autumn semester.

Code	Name	Credits
CHEM-A1610	Design Meets Biomaterials	3 - 5 (For minor students always 5 ECTS)
MUO-C1044	CHEMARTS Summer School	10 - 15

Industrial Environment

Otsikko

Biomass refining

Code: CHEM3029

Extent: 20 - 25 cr

Language: English

Professor in charge: Herbert Sixta

Target group: Master's students

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: Please note, that in some courses the number of participants can be limited. Then major students (Biomass Refining) have the priority.

Prerequisites: While making your studyplan, you should verify that you have the prerequisites needed for the courses.

Content and structure of the minor

Minor (20 - 25 cr) can be any combination of courses belonging to the Biomass Refining major. Please check the list below,

Structure of the minor

Code	Name	Credits
Elective courses		20-25
Choose so many courses below that the Minor will be at least 20 cr		
CHEM-E0100	Academic Learning Community	5
CHEM-E1110	Lignocellulose Chemistry	5
CHEM-E1100	Plant Biomass	5
CHEM-E7100	Engineering Thermodynamics, Separation Processes, part I	5
CHEM-E7110	Engineering Thermodynamics, Separation Processes, part II	5
CHEM-E1120	Thermochemical Processes	5
CHEM-E1130	Catalysis	5
CHEM-E1140	Catalysis for Biomass Refining	5
CHEM-E3140	Bioprocess Technology II	5
CHEM-E1150	Biomass Pretreatment and Fractionation – in Class	5
CHEM-E1160	Biomass Pretreatment and Fractionation – in Laboratory	5
CHEM-E1200	Integration and Products	10

Biosystems and Biomaterials Engineering

Code: CHEM3036

Extent: 20-25 cr

Language: English

Professor in charge: Alexander Frey

Target group: Students from Masters' programme in Life Science Technologies, Master's Programme in Chemical, Biochemical and Materials Engineering and other Master students with sufficient prerequisites

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: Please note, that in some courses the number of participants can be limited. Then major students (Biosystems and -materials) have the priority.

Prerequisite knowledge: Attendance of the minor in Biosystems and –materials presupposes basic knowledge and competences in the disciplines of Natural Sciences (Biology, Chemistry, Physics) Also while making your studyplan, you should verify that you have the prerequisites needed for the courses.

Objectives

The minor provides an overview on biological phenomena and cellular systems, biomaterials and pharmaceutically active molecules important to the field of Life science. Students can tailor the minor according to their interests.

1. the understanding of molecular and cellular level phenomena and the use of such knowledge for the analysis and reprogramming of cells
2. molecular design and characterization of small pharmaceutically active molecules
3. synthesis and characterization of biomaterials

Content and structure of the minor

The minor includes 20-25 credits of mandatory courses. Suitable courses can be selected from the list.

Structure of the minor

Code	Name	Credits	
Recommended courses for study option a)			Period
CHEM-E8120	Cell Biology	5	III
CHEM-E3150	Biophysical chemistry	5	III
CHEM-E3120	Microbiology	5	I
CHEM-E8115	Cell factory	5	III
CHEM-E8135	Microfluidics and BioMEMS	5	III
CHEM-E8125	Synthetic biology	5	IV-V
CHEM-E3170	Systems biology	5	IV-V
Recommended courses for study option B)			
CHEM-E8100	Organic Structural Analysis	5	I
CHEM-E8130	Medicinal Chemistry	5	II
CHEM-E4245	Natural Product Chemistry	5	II
CHEM-E4140	Selectivity in Synthesis and Recognition	5	II
Recommended courses for study option C)			
CHEM-E2100	Polymer Synthesis	5	I
CHEM-E2130	Polymer Properties	5	II
CHEM-E2150	Interfacial Phenomena in Biobased Systems	5	III-IV
CHEM-E2155	Biopolymers	5	III-IV

For pursuing option a) Cell biology is a mandatory course.

Biotechnology

Code: CHEM3030

Extent: 20 - 25 cr

Language: English

Professor in charge: Katrina Nordström

Target group: Master's students

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: Please note, that in some courses the number of participants can be limited. Then major students (Biotechnology)) have the priority.

Prerequisites: While making your studyplan, you should verify that you have the prerequisites needed for the courses.

Content and structure of the minor

For the minor (20 - 25 credits) all students have to take the same compulsory studies of 15 cr. Additionally the student needs to select specialisation studies of 5 - 10 cr.

Structure of the minor

Code	Name	Credits
Mandatory courses		15
CHEM-E3100	Biochemistry	5
CHEM-E3120	Microbiology	5
CHEM-E3140	Bioprocess technology II	5
Elective courses		5-10
Choose so many courses below that the Minor will be at least 20 cr		
CHEM-E3150	Biophysical chemistry	5
CHEM-E3170	Systems biology*	5
CHEM-E3205	Bioprocess optimization and simulation	5
CHEM-E3125	Advanced Biochemistry	5
CHEM-E3225	Cell- and Tissue Engineering*	5
CHEM-E8125	Synthetic biology	5
CHEM-E8115	Cell factory	5
CHEM-E8120	Cell Biology**	5

*The number of students pursuing a minor that may take these courses depends on number of students taking these in their major.

CHEM-E8120 Cell Biology is prerequisite for CHEM-E3170 Systems Biology.

Chemical engineering

Code: CHEM3031

Extent: 20 - 25 cr

Language: English

Professor in charge: Ville Alopaeus

Target group: Master's students

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: Please note, that in some courses the number of participants can be limited. Then major students (Chemical Engineering) have the priority.

Prerequisites: While making your studyplan, you should verify that you have the prerequisites needed for the courses.

Content and structure of the minor

For the minor (20 - 25 credits) the students have to take compulsory studies 15 - 25 cr (from Chemical Engineering major's compulsary courses. NB! Not CHEM-E7200 Design project or CHEM-E7120 Lab project). Additionally the student needs to select specialisation studies of 0 - 10 cr. Please check the list below.

Structure of the minor

Code	Name	Credits
Mandatory courses		15-25
CHEM-E0100	Academic Learning Community	5
CHEM-E7100	Engineering Thermodynamics, Separation Processes, part I	5
CHEM-E7110	Engineering Thermodynamics, Separation Processes, part II	5
CHEM-E7130	Process Modeling	5
CHEM-E7140	Process Automation	5
CHEM-E7150	Reaction Engineering	5
CHEM-E7160	Fluid Flow in Process Units	5
Elective courses		0-10
Choose so many courses below that the Minor will be at least 20 cr		
CHEM-E7105	Process Development	5
CHEM-E7115	Experimental Assignment in Chemical Engineering	5
CHEM-E7135	Reactor Design	5
CHEM-E7165	Advanced Process Control Methods	5
CHEM-E7155	Production Planning and Control	5
CHEM-E1130	Catalysis	5
CHEM-E2145	Polymer Reaction Engineering	5

Chemistry

Code:CHEM3032

Extent: 20 - 25 cr

Language: English

Professor in charge: Kari Laasonen

Target group: Master's students

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: Please note, that in some courses the number of participants can be limited. Then major students (Chemistry) have the priority.

Prerequisites: While making your studyplan, you should verify that you have the prerequisites needed for the courses.

Content and structure of the minor

For the minor (20 -25 credits) all students have to take the same compulsory courses (20 cr). These courses will give a good basic knowledge of chemistry.

If the student is interested of some subtopic of chemistry he/she can take courses in those fields and to include them to the elective courses. In this case we strongly recommend the students to contact Anna Mäkilä or the professors. (See courses from Into).

Structure of the minor

Code	Name	Credits
Mandatory courses		20
CHEM-E4130	Chemistry of the Elements	5
CHEM-E4140	Selectivity in Synthesis and Recognition	5
CHEM-E4110	Quantum mechanics and Spectroscopy	5
CHEM-E4120	Quantitative Instrumental Analysis	5

Fibre and polymer engineering

Code: CHEM3033

Extent: 20 - 25 cr

Language: English

Professor in charge: Mark Hughes

Target group: Master's students

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: Please note, that in some courses the number of participants can be limited. Then major students (Fibre and Polymer Engineering) have the priority.

Prerequisites: While making your studyplan, you should verify that you have the prerequisites needed for the courses.

Content and structure of the minor

For the minor (20 - 25 credits) all students have to take the same compulsory studies of 15 cr. Additionally the student needs to select elective studies of 5 - 10 cr. Please check tha list below.

Structure of the minor

Code	Name	Credits
Mandatory courses		15
CHEM-E2160	Product Development Practices	5
CHEM-E2210	Product Development- Project Course	10
Elective courses		5-10
Select 1–2 courses below so that the Minor will be 20–25 cr.		
CHEM-E2100	Polymer synthesis	5
CHEM-E2110	Polymer properties	5
CHEM-E2130	Fibres and fibre products	5
CHEM-E2140	Cellulose-based fibres	5
CHEM-E2150	Surface chemistry	5
CHEM-E2200	Polymer blends and composites	5
CHEM-E2105	Wood and wood products	5
CHEM-E2115	Wood products: application and performance	5
CHEM-E2125	Web-based natural fiber products	5
CHEM-E2135	Converting of web-based products	5
CHEM-E2145	Polymer reaction engineering	5
CHEM-E2155	Biopolymers	5

Functional materials

Code:CHEM3034

Extent: 20 - 25 cr

Language: English

Professor in charge: Sami Franssila

Target group: Master's students

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: Please note, that in some courses the number of participants can be limited. Then major students (Functional Materials) have the priority.

Prerequisites: While making your studyplan, you should verify that you have the prerequisites needed for the courses.

Content and structure of the minor

For the minor (20 - 25 credits) all students have to take the same compulsory studies of 10 cr. Additionally the student needs to select 2 - 3 courses (10 - 15 cr) from Functional Materials major's compulsory courses. Please check the list below.

Structure of the minor

Code	Name	Credits
Mandatory courses		10
CHEM-E5100	Solid State Materials and Phenomena	5
CHEM-E5120	Interfaces and Nanomaterials	5
Elective courses		10-15
Choose two-three courses from Functional materials courses.		
CHEM-E5110	Metallic Materials	5
CHEM-E5130	Laboratory Course in Functional Materials	5
CHEM-E5140	Materials Characterization, laboratory course	5
CHEM-E2130	Polymer Properties	5

Sustainable metals processing

Code:CHEM3035

Extent: 25 cr

Language: English

Professor in charge: Pekka Taskinen

Target group: Master's students

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: Please note, that in some courses the number of participants can be limited. Then major students (Sustainable Metals Processing) have the priority.

Prerequisites: While making your studyplan, you should verify that you have the prerequisites needed for the courses.

Content and structure of the minor

Minor (20 - 25 cr) can be any combination of courses belonging to the Sustainable Metals Processing major. Please check tha list below.

Structure of the minor

Code	Name	Credits
Elective courses		20-25
Choose so many courses below that the Minor will be at least 20 cr		
CHEM-E6100	Fundamentals of Chemical Thermodynamics	5
CHEM-E6120	System Integrated and Sustainable Metals Production	5
CHEM-E6140	Fundamentals of Minerals Engineering and Recycling	5
CHEM-E6160	Fundamentals of Pyrometallurgy	5
CHEM-E6180	Fundamentals of Hydrometallurgy	5
CHEM-E7130	Process Modeling	5
CHEM-E6200	Materials processing & synthesis	10

CHEM minors only for students of CHEM

CHEM minors only for students of CHEM

In the guide, the CHEM minors have been classified under two headings: CHEM minors for all Aalto students and CHEM minors only for CHEM students.

On the page **CHEM minors for all Aalto students** you can find information about those CHEM minors which are primarily open for all Aalto University students. Please note that some of such minors may, however, be offered only to students of certain majors/departments.

Under **CHEM minors only for CHEM students**, you can find information about those minors which are intended only for students of CHEM.

The more specific target groups of each minor are explained in the descriptions of the minors. The descriptions also provide information on the application procedure and any restrictions regarding applicants.

CHEM minors only for students of CHEM

Minor	Extent (ECTS)	Language of instruction
Biotechnology and Chemical Engineering	20	Finnish
Materials Science and Engineering	20	Finnish
International Studies Minor	20 - 25	To be agreed
Individual Minor Subject	20 - 25	To be agreed

Individual Minor Subject

Sivuaineen perustiedot

Koodi: SCI3040

Laajuus: 20-25 op

Kieli: Sopimuksen mukaan

Sivuaineen vastuuprofessori:

- Kandidaatin tutkinto: Pääaineiden vastuuprofessorit
- Diplomi-insinöörin tutkinto: Ohjelman johtajat

Kohderyhmä: Perustieteiden korkeakoulun opiskelijat

Kiintiöt ja rajoitukset: Vain vuoden 2013 tutkintosäännön mukaan opiskeleville.

Sivuaineen nimi muilla kielillä: Personligt biämne, Individual Minor Subject

Sivuaineen sisältö ja rakenne

Henkilökohtainen sivuaine on tarkoitettu ensisijaisesti opiskelijoille, jotka vaihtavat vuoden 2005 tutkintosäännöstä vuoden 2013 tutkintosääntöön, ja joilla on jo suoritettuna vanhan rakenteen mukaisia sivuaineopintoja, mutta vastaavaa sivuainetta ei enää ole uudessa tutkintorakenteessa.

Henkilökohtainen sivuaine voidaan vahvistaa HOPSiin vain perustellusta syystä. Sivuainetta ei voi käyttää sekalaisen kurssikokoelman koostamiseen sivuaineeksi, vaan siihen sisällytettävien opintojen tulee muodostaa sisällöllisesti selkeä, nimettävissä oleva kokonaisuus. Sivuaineen kandidaatin tutkintoon hyväksyy pääaineen professori ja diplomi-insinöörin tutkintoon ohjelman johtaja.

Pääsääntöisesti sivuaine valitaan edelleenkin Aalto-yliopistossa vahvistetuista sivuainekokonaisuuksista, suoritetaan vaihdossa ulkomailla tai tehdään JOO-opintoina toisessa kotimaisessa yliopistossa.

International Studies Minor

Basinformation om biämnet

Kod: CHEM3020

Omfattning: 20-25 cr

Språk: Se *Biämnets innehåll och uppbyggnad*

Biämnets ansvarsprofessor: Tapani Vuorinen

Målgrupp: Endast för studerande vid CHEM

Biämnets namn på andra språk: Kansainvälinen sivuaine / International minor

Biämnets innehåll och uppbyggnad:

Den internationella biämneshelheten bildas av studier som är avlagda på utbyte utomlands och som lämpar sig till teknologie kandidatexamen. Utöver kunskapsmässigt innehåll ger helheten kunskaper gällande språk, mångkulturellt umgänge samt självständigt arbete, som den studerande tillägnar sig genom att studera och vistas utomlands.

Syftet med den internationella biämneshelheten är att i examen inkludera en studiehelhet som ger internationella färdigheter och bilder en yrkesprofil med stark internationell dimension.

Kansainvälinen sivuaine koostuu seuraavista komponenteista:

- Lähtö- ja paluuorientaatio
- Sivuaineen substanssiopinnot (min 15 op)
- Kieli- ja kulttuuriopintoja (max 10 op)
- Aalto-yliopistossa suoritettavia opintoja, jotka täydentävät sivuainetta (max 5 op)
- Kohdemaassa suoritettava harjoittelu (max 5 op)

Huomaa! Vaihtoon valituille opiskelijoille järjestetään lähtöorientaatio- ja paluuorientaatiotilaisuudet vuosittain. Orientaatioihin osallistuminen on pakollinen osa kv-sivuainekokonaisuuden suorittamista. Tilaisuuksista tiedotetaan erikseen ja niihin tulee ilmoittautua. Mikäli opiskelija on estynyt osallistumasta kyseisiin tilaisuuksiin, tulee opiskelijan tehdä korvaava suoritus (esseemuotoinen tehtävä). Korvaavasta suorituksesta lisätietoja antavat vaihdon suunnittelijat (international-chem@aalto,fi).

CHEM individual courses for all Aalto students

CHEM individual courses for all Aalto students

Degree students at other Aalto Schools do not need to separately apply for a study right in order to complete courses at the School of Chemical Technology.

From the pool of enrolled students, participants for the course are chosen according to a prioritizing order defined for the course. If there is such a prioritizing order defined for the course, it is explained in the course description. Before enrolling for the course, check the preliminary requirements at weboodi: https://oodi.aalto.fi/a/frame.jsp?Kieli=6&valittuKieli=6.

You can find the School of Chemical Technology course listing at weboodi https://oodi.aalto.fi/a/frame.jsp?Kieli=6&valittuKieli=6.

Contact information

School of Chemical Technology

Planning Officer Kaisa Pulliainen
kaisa.pulliainen@aalto.fi
tel. 050 511 2079

ELEC minors for all Aalto students

In the guide, the minors offered by the School of Electrical Engineering (ELEC) have been classified under two headings: ELEC minors for all Aalto students and ELEC minors only for ELEC students.

On the page **ELEC minors for all Aalto students** you can find information about those ELEC minors which are primarily open for all Aalto University students. Please note that some of such minors may, however, be offered only to students of certain majors/departments.

Under **ELEC minors only for ELEC students**, you can find information about those minors which are intended only for students of ELEC.

The more specific target groups of each minor are explained in the descriptions of the minors. The descriptions also provide information on the application procedure and any restrictions regarding applicants.

ELEC minors for all Aalto students

Minor	Extent (ECTS)	Language of instruction
Minors on B.Sc. level		
Information Technology (IT)	25	Finnish
Bioinformation Technology (BioIT)	25	Finnish
Electronics and Electrical Engineering (EST)	25	Finnish
Automation and Control Engineering (AUT)	25	Finnish
Minors on M.Sc. level		
Acoustics and Audio Technology	20-25	English
Advanced Materials and Photonics	25	English
Biosensing and -electronics	20	English
Communications Engineering	30	English
Control, Robotics and Autonomous Systems	20	English
Electrical Power and Energy Engineering	20	English
Micro- and Nanoelectronic Circuit Design	25	English
Micro and Nanosciences	25	English
Radio Science and Engineering	25	English
Signal, Speech and Language Engineering	20-25	English

Space Science and Technology	25	English
Translational Engineering	20	English

Acoustics and Audio Technology

Code: ELEC3033

Extent: 20-25 credits

Language: English

Professors in charge: Tapio Lokki (SCI), Lauri Savioja (SCI), Vesa Välimäki (ELEC)

Target group: All students with sufficient prerequisite knowledge.

Application procedure: No separate application procedure.

Prerequisites: Recommended ELEC-C5230 Digitaalisen signaalinkäsittelyn perusteet.

Content and structure of the minor

The minor in Acoustics & Audio Technology offers fundamental knowledge about acoustical phenomena, human hearing and audio technologies, and also facilitates the students to apply the knowledge in practice.

The fields of electroacoustics, room and building acoustics, noise, musical acoustics, and audio signal processing are focus-points of the studies. Technical Psychoacoustics that deals with human hearing mechanisms is central to the studies, as a cornerstone in the development of acoustical and audio technologies for human listeners. Put together, these fields constitute Communication Acoustics, where a human listener is always at the end of the acoustic communication channel. Currently, Digital Signal Processing is also an important tool in the Acoustics and Audio Engineering, and hence the teaching emphasizes both the understanding of its general principles and the fundamental audio processing algorithms.

Structure of the minor

The minor consists of one compulsory course and 3-4 optional courses:

Code	Name	Credits	Professor in charge	Teaching period(s)
Mandatory courses		5		
ELEC-E5600	Communication Acoustics	5	Prof. Ville Pulkki	I
Optional courses Choose 3-4 courses		15-20		
ELEC-E5610	Acoustics and the Physics of Sound	5	Prof. Ville Pulkki	II

ME-E2430	Acoustical Measurements L	5	Prof. Tapio Lokki	II
ELEC-E5620	Audio Signal Processing L	5	Prof. Vesa Välimäki	III-IV
ME-E2420	Room Acoustics L	5	Prof. Lauri Savioja	III-IV
ELEC-E5630	Acoustics and Audio Technology Seminar L (varying content)		Profs. Lokki, Savioja, Välimäki	IV-V

Advanced Materials and Photonics

Code: ELEC3040

Extent: 25 credits

Language: English

Professors in charge: Ilkka Tittonen, Erkki Ikonen, Esa Kallio, Harri Lipsanen, Hele Savin, Konstantin Simovski, Markku Sopanen, Zhipei Sun and Sergei Tretyakov

Target group: All students with sufficient prerequisite knowledge.

Application procedure: No separate application procedure.

Structure of the minor

Code	Name	Credits	Teaching period
Choose 5 courses from this list		25	
ELEC-E3120	Analysis and Design of Electronic Circuits	5	I-II
ELEC-E4130	Elecromagnetic Fields	5	I-II
ELEC-E3140	Semiconductor Physics	5	I-II
ELEC-E3150	Mathematical Methods	5	I-II
ELEC-E3210	Optoelectronics	5	III
ELEC-E3220	Semiconductor Devices	5	III
ELEC-E3230	Nanotechnology	5	IV
ELEC-E3240	Photonics	5	V
ELEC-E3280	Micronova Laboratory Course	5	I-II
ELEC-E3290	Micronova Special Assignment	5	III-V
CHEM-E5115	Microfabrication	5	I-II
PHYS-C0220	Thermodynamics and Statistical Physics	5	IV-V

PHYS-E0414	Advanced Quantum Mechanics	5	I-II
PHYS-E0416	Quantum Physics	5	III-IV
PHYS-E0421	Solid-State Physics	5	IV-V
PHYS-E0422	Soft Condensed Matter Physics	5	III-IV
PHYS-E0435	Optical Physics	5	I-II
PHYS-E0436	Modern Optics V	5	IV-V (every other year, starting 2015)
PHYS-E0437	Laser Physics	5	IV-V (every other year, starting 2016)
ELEC-E4810	Metamaterials and Nanophotonics	5	I-II (2016)
ELEC-E5730	Optics	5	I
ELEC-E4520	Space Physics	5	IV-V

Biosensing and Bioelectronics

Professor in charge: Tomi Laurila

Professors: Mervi Paulasto-Kröckel, Ilkka Tittonen, Raimo Sepponen

Extent: 20 credits

Abbreviation: -

Code: ELEC3046

Target group: Students from Masters' programme in Life Science Technologies and other Master students with sufficient prerequisites

Language: English

Prerequisite knowledge

Studies encompassing at least 60 credits in mathematics, chemistry/materials science, physics and computer programming, and BSc in Bioinformation Technology or equivalent knowledge.

Objectives

After completing the minor the student has acquired the basic understanding of biomolecular science and bioelectrical phenomena, and comprehends how to use this understanding in the development of biosensing devices and bioelectrical instruments.

Content and structure

Code	Name	Credits	Period/year
Mandatory courses of the minor (20 Credits)			
ELEC-E3260	Biomolecules	5	III
ELEC-E8726	Biosensing	5	II-IV
ELEC-E8728	Tissue-foreign Body Interfacial Reactions	5	I-II
ELEC-E8734	Biomedical Instrumentation	5	II

Electrical Power and Energy Engineering

Biämne på svenska: Elkraftteknik

Minor in Finnish: Sähköenergiatekniikka

Code: ELEC3027

Responsible professors: Marko Hinkkanen, Matti Lehtonen

Extent: 20 credits

Language: English

Preliminary requirements:

Bachelor’s degree in Electrical Engineering or equivalent.

Objectives and learning outcomes

Electrical power and energy systems form the backbone of societies. Intelligent systems, spanning from production to end-user, ensure optimal utilisation of resources — minimal impact on environment, maximal benefits for society. The field includes transmission, distribution, smart grid, and sustainable generation and utilisation of electrical power, as well as power-conversion devices such as motors, generators, and power-electronic converters. This minor offers a theoretical base needed by engineers working on the field of electrical power and energy engineering.

Upon completion of the Minor, the student will be able to:

- Identify fundamental aspects and considerations for electrical energy systems

- Analyze and evaluate existing and future challenges in the field of electrical power and energy engineering

- Analyze power systems and energy conversion devices

Content of the minor

The minor consists of 20 credits in total. Students may either choose to complete four compulsory courses of their choice or three compulsory courses and one elective course as given in the list below.

Code	Course	ECTS	Teaching period
Compulsory courses - Choose a minimum of 3 courses (15 credits) from the list below		15	
ELEC-E8405	Electric Drives	5	I-II
ELEC-E8407	Electromechanics	5	I-II
ELEC-E8001	Embedded Real-Time Systems	5	I-II
ELEC-E8412	Power Electronics	5	I-II
ELEC-E8413	Power Systems	5	I-II
Optional courses - Choose 1 course (5 credits) from the list below		5	
PHYS-E6573	Advances in New Energy Technologies	5	III-IV
ELEC-E8712	Design for Reliability	5	I-II
ELEC-E8730	Design of Electronic Equipment	5	I-II
ELEC-E8731	Design of Electronic Prototype	5	III-IV
ELEC-E8408	Embedded Systems Development	5	III-IV
PHYS-E6571	Fuel Cells and Hydrogen Technology	5	III-IV (alt. years)
PHYS-C6370	Fundamentals of New Energy Sources	5	I-II
CS-E5340	Introduction to Industrial Internet	5	III-IV
KON-C2004	Mechatronic Basics	5	II
PHYS-C1380	Multi-disciplinary energy perspectives	5	III-IV
ELEC-E8700	Principles and fundamentals of lighting	5	I-II
ELEC-D8710	Principles of materials science	5	III-IV
ELEC-E8702	Rakennusähköistys	5	III-V
ELEC-E8414	Seminar on Electromechanics L	5	IV
ELEC-E8415	Special Assignment in Electrical Power and Energy Engineering	5	I, II, III, IV; V
ELEC-E8416	Special Course on Electromechanics	5	I-II

ELEC-L8402	Special Topics in Industrial Electronics I P	5	I-II
ELEC-L8403	Special Topics in Industrial Electronics II P	5	III-IV
ELEC-E8420	Sähkönsiirtojärjestelmät 2 (Power Transmission Systems 2)	5	IV-V

Communications Engineering

Code: ELEC3032

Extent: 20 credits

Language: English

Professor in charge: Riku Jäntti

Target group: All students with sufficient prerequisite knowledge.

Application procedure: No separate application procedure.

Content and structure of the minor

Students taking the Communications Engineering minor are given lots of choice in selecting different topics inside the broad field of Communications Engineering. Students are equipped to develop a deep understanding of Internet Technologies, Wireless Technologies and Communications Ecosystems, and upon completing the minor will be able to apply their new knowledge and skills for practical situations and actual cases.

The courses related to Internet Technologies provide a solid basis for understanding the design principles, theory and practice of the core technologies and protocols of the Internet, both in wireless and fixed network communication. As well as offering a solid theoretical background, many courses also involve practical projects that deal with the current state-of-the-art Internet protocols and applications.

The courses related to Wireless Communications focus on various techniques of physical, link and network layers utilized in modern wireless communication systems, as well as the methods used to design, evaluate and deploy them.

The courses related to Communications Ecosystems offer education in the areas of technology, economics, and user behavior in the context of communications networks and services. Students learn multiple skills and systems-thinking, and will be able to collaborate with experts from other fields such as economics, sociology or design.

Structure of the minor

Code	Name	Credits	Teaching period
Choose at least one of the following courses			
ELEC-E7120	Wireless Systems	5	I
ELEC-E7130	Internet Traffic Measurements and Analysis	5	I
Choose to fulfill 20 credits *			
* Check the **prerequisites**! In order to do the Master's thesis in Communcations Engineering minor you must have your study plan discussed and approved with the supervising professor.			
ELEC-E5420	Convex Optimization for Engineers L	5	I-II
ELEC-E5410	Signal Processing for Communications	5	I-II
ELEC-E5440	Statistical Signal Processing	5	I-II
ELEC-E7210	Communication Theory	5	I-II
ELEC-E7220	Radio Resource and Spectrum Management P	5	IV
ELEC-E7230	Mobile Communication Systems	5	I
ELEC-E7240	Coding Methods L	5	III
ELEC-E7250	Laboratory Course in Communications Engineering	5	III-V
ELEC-E7260	Machine Learning for Mobile and Pervasive systems P	5	II-III
ELEC-E7320	Internet Protocols	5	III-IV
ELEC-E7330	Laboratory Course in Internet Technologies	5	I-II
ELEC-E7410	Communication Transmission Lines	5	V
ELEC-E7420	Network Service Provisioning L	5	I-II
ELEC-E7450	Performance Analysis L	5	V
ELEC-E7460	Modelling and Simulation L	5	I-II
ELEC-E7470	Cybersecurity L	5	V
ELEC-E7810	Patterns in Communications Ecosystems	5	IV-V
ELEC-E7820	Operator Business	5	I
ELEC-E7830	Value Network Design for Internet Services	5	III-IV
ELEC-E7851	Computational User Interface Design	5	II
ELEC-E7861	Research Project in Human-Computer Interaction P	5-10	IV
ELEC-E7880	Quality of Experience	3	I-IV
ELEC-E7890	User Research P	5	I
ELEC-E7910	Special Project in Communications Engineering	2-10	I, II, III, IV, V

Control, Robotics and Autonomous Systems

Biämne på svenska: Reglerteknik, robotik och autonomiska system

Minor in Finnish: Säätötekniikka, robotiikka ja autonomiset järjestelmät

Code: ELEC3028

Responsible professors: Ville Kyrki, Valeriy Vyatkin

Extent: 20 credits

Language: English

Preliminary requirements:

Bachelor's degree from any of the Aalto schools of technology and ELEC3019 Automation and Control Engineering minor or equivalent.

Objectives and learning outcomes

The minor extends the bachelor-level minor of Automation and Control Engineering. It offers deeper understanding of modelling, estimation and control of dynamical systems. In addition students will study the development of distributed automation systems.

Learning objectives:

A student

- Is able to develop software for distributed automation systems
- Is able to model dynamical systems
- Is be able to design controllers for dynamical systems

Content of the minor

The minor consists of 20 credits in total. Students may either choose to complete all compulsory courses or three compulsory courses and one elective course as given in the list below.

Code	Name	Credits	Teaching Period
Compulsory courses - Choose a minimum of 3 courses (15 credits) from the list below		15	
ELEC-E8101	Digital and Optimal Control	5	I-II
ELEC-E8102	Distributed and Intelligent Automation Systems	5	I-II
ELEC-E8103	Modelling, Estimation and Dynamic Systems	5	I
ELEC-E8104	Stochastic Models and Estimation	5	I

Optional courses - Choose 1 course (5 credits) from the list below

ELEC-E8110	Automation Software Synthesis and Analysis	5	IV-V
ELEC-E8111	Autonomous Mobile Robotics	5	IV
ELEC-E8001	Embedded Real-Time Systems	5	I-II
ELEC-E8113	Information Systems in Industry	5	I-II
ELEC-E8114	Manufacturing Automation Systems Modelling	5	IV-V
ELEC-E8115	Micro and Nano Robotics	5	III-IV
ELEC-E8116	Model-Based Control Systems	5	IV-V
ELEC-E8117	Modelling and Control of Field Systems	5	III-IV
ELEC-E8118	Robotic Vision	5	III
ELEC-E8119	Robotics: Manipulation, Decision Making and Learning	5	I-II

Micro- and Nanoelectronic Circuit Design

Code: ELEC3036

Extent: 25 credits

Language: English

Professors in charge: Jussi Ryynänen and Kari Halonen

Target group: All students with sufficient prerequisite knowledge.

Application procedure: No separate application procedure.

Structure of the minor

Code	Name	Credits	Teaching period
Compulsory courses		15	
ELEC-E3120	Analysis and Design of Electronic Circuits *	5	I-II
ELEC-E3510	Basics of IC Design	5	III
ELEC-E3520	Digital Microelectronics I	5	III
Optional courses		10	
ELEC-E3530	Integrated Analog Systems	5	IV-V
ELEC-E3540	Digital Microelectronics II	5	IV-V
ELEC-E3550	Integrated RF-circuit	5	IV-V
ELEC-E3560	IC Design Project	5	IV-V

* This is a compulsory course, if it is not a part of the student's programme.

Micro and Nanosciences

Code: ELEC3042

Extent: 25 credits

Language: English

Prifessors in charge: Markku Sopanen, Harri Lipsanen, Hele Savin, Zhipei Sun and Ilkka Tittonen

Target group: All students with sufficient prerequisite knowledge.

Application procedure: No separate application procedure.

Structure of the minor

Code	Name	Credits	Teaching period
Compulsory courses		15	
ELEC-E3210	Optoelectronics	5	III
ELEC-E3220	Semiconductor Devices	5	III
ELEC-E3230	Nanotechology	5	IV
ELEC-E3280	Photonics	5	V
Optional courses		10	
ELEC-E3210	Optoelectronics	5	III
ELEC-E3220	Semiconductor Devices	5	III
ELEC-E3230	Nanotechology	5	IV
ELEC-E3280	Photonics	5	V
ELEC-E3280	Micronova Laboratory Course	5	I-II
ELEC-E3290	Micronova Special Assignment	5	I-V
CHEM-E5115	Microfabrication	5	
ELEC-E3250	Optical Fibers: Physics and Applications L	5	II
ELEC-E4810	Metamaterials and Nanophotonics	5	I-II
ELEC-E5730	Optics	5	I

Radio Science and Engineering

Code: ELEC3043

Extent: 25 credits

Language: English

Professors in charge: Sergey Tretyakov, Antti Räisänen, Konstantin Simovski, Keijo Nikoskinen, Ari Sihvola, Katsuyuki Haneda and Ville Viikari

Target group: All students with sufficient prerequisite knowledge.

Application procedure: No separate application procedure.

Prerequisites: While making your study plan, you should verify that you have the pre-requisites (i.e. the understanding of electromagnetic fields, of electronic circuit design, and of relevant mathematical methods) needed for the compulsory course (Microwave Engineering I). If you do not feel confident, it is strongly recommended that you choose relevant basic courses, i.e. ELEC-E3120, ELEC-E4130 and/or ELEC-E3150, from the course list below to attend before the compulsory course.

Structure of the minor

There is one compulsory course: ELEC-E4420 Microwave Engineering 1 (5 ECTS). At least two elective courses are to be chosen from Radio Science and Engineering related courses, see list below (10 ECTS), and two elective courses can be chosen from any ELEC-E4xxx courses (10 ECTS). Total credits required: 25 ECTS.

Code	Name	Credits	Teaching period
Compulsory course		5	
ELEC-E4420	Microwave Engineering I	5	III-IV
Optional courses		20	
ELEC-E4410	Electromagnetic and circuit simulations	5	III
ELEC-E3120	Mathematical Methods	5	I-II
ELEC-E4130	Electromagnetic Fields	5	I-II
ELEC-E3150	Analysis and Desgn of Electronic Circuits	5	I-II
ELEC-E4430	Microwave Engineering II	5	IV-V
ELEC-E4440	Microwave Engineering Workshop	5	I-III
ELEC-E4450	Antennas	5	IV-V
ELEC-E4710	Computational Electromagnetics	5	IV-V
ELEC-E4720	Advanced Circuit Theory	5	IV-V
ELEC-E4730	Advanced Field Theory	5	IV-V
ELEC-E4740	Antennas Workshop	5	I-II
ELEC-E4750	Radiowave Scattering and Propagation	5	I-II
ELEC-E4760	Terahertz Techniques	5	V
ELEC-E4770	MIMO Radios	5	I-II (starts in 2017)

Two of the four elective courses can be chosen from any ELEC-E4xxx course; 10 credits.

Signal, Speech and Language Processing

Code: ELEC3034

Extent: 20-25 credits

Language: English

Professor in charge: Mikko Kurimo

Target group: All students with sufficient prerequisite knowledge.

Application procedure: No separate application procedure.

Prerequisites: There are no compulsory prerequisite courses. However, in order to succeed in the minor the student needs programming skills, basic understanding of linear systems, basic knowledge and skills in analog and digital signal processing, and good skills in mathematics (especially in linear algebra, calculus, probability theory and statistics). Some helpful preparation from Aalto University would include for example, the MS-A0003 Matrix Algebra (ELEC1) or similar courses, the MS-A0501 First Course in Probability and Statistics or similar, the ELEC-A7100 Basic Course in C programming, ELEC-A7200 Signals and Systems, ELEC-C5230 Digital Signal Processing Basics, ELEC-C5340 Applied Digital Signal Processing and ELEC-C5210 Stochastic Processes in Communications.

Content and structure of the minor

The purpose of the minor is to provide the students with a background in either Modern Signal Processing or Speech and Language Processing. Courses in Signal Processing provide a toolbox of knowledge on signals and systems modeling, representation through transforms, and systems optimization and implementation. Some emphasis will be given on the most recent research priorities in the field of signal processing, such as the domains of data analysis, compression and storage, communications and representation of signals. Courses in Speech Processing provide the students with the basics of speech and language processing, as well as the ability to apply those in various fields of science and technology. Speech and Language Processing utilizes signal processing, mathematical modeling and machine learning for statistical language modeling, information retrieval, and speech analysis, synthesis, recognition and coding.

Structure of the minor

The minor consist of two common compulsory courses (10 cr) and two or three elective courses (10-15 cr).

Code	Name	Credits	Teaching period
Compulsory courses		10	
ELEC-E5410	Signal Processing for Communications	5	I-II
CS-E3210	Machine Learning: Basic Principles	5	I-II

Optional courses Choose 10 credits.		10	
CS-E4600	Algorithmic Methods of Data Mining	5	I-II
ELEC-E5420	Convex Optimization for Engineers	5	I-II
ELEC-E5430	Signal Processing for Large Scale Data Analysis	5	III-IV
ELEC-E5440	Statistical Signal Processing	5	I-II
ELEC-E5500	Speech Processing	5	I
ELEC-E5510	Speech Recognition	5	II
ELEC-E5520	Speech and Language Processing Methods	2	III-IV
ELEC-E5530	Speech and Language Processing Seminar	3	III-IV
ELEC-E5550	Statistical Natural Language Processing	5	III-IV

Space Science and Technology

Code: ELEC3044

Extent: 25 credits

Language: English

Professors in charge: Anne Lähteenmäki, Esa Kallio, Jaan Praks, Tuija Pulkkinen and Miina Rautiainen

Target group: All students with sufficient prerequisite knowledge.

Application procedure: No separate application procedure.

Structure of the minor

Code	Name	Credits	Teaching period
Compulsory courses		10	
ELEC-E4210	Introduction to Space	5	III-IV
ELEC-E4240	Satellite Systems L	5	I-V
Optional courses Choose two or three rom the list below		15	
ELEC-E4220	Space Instrumentation L	5	I-II
ELEC-E4230	Microwave Earth Observation Instrumentation L	5	I-II
ELEC-E4530	Radio Astronomy L	5	I-II
ELEC-E4510	Earth Observation L	5	III-IV
ELEC-E4520	Space Physics L	5	IV-V
ELEC-E4930	Space Technology Project	5-10	all periods

ELEC-E4940	Special Assignment in Space Science and Technology	5-10	all periods

Choose one or none from any ELEC-E44xy or ELEC-E47xy courses

Translational Engineering

Biämne på svenska: Translationell teknik

Minor in Finnish: Translationaalinen tekniikka

Code: ELEC3026

Responsible professors: Mervi Paulasto-Kröckel and Simo Särkkä

Extent: 20 credits

Language: English

Preliminary requirements:

No preliminary requirements – open for all Aalto students – but please note that all courses in this minor are at Master's level and students should ensure that they have the necessary knowledge and skills before choosing this minor.

Objectives and learning outcomes

Translational engineering is a multidisciplinary topic dealing with themes from various fields, such as biomedical engineering, health care and wellbeing, microsystems technology and smart living environment. Drawing from a strong mathematical and natural sciences basis, the minor offers in depth knowledge about different application areas related to the above mentioned fields. The minor also emphasizes the process of transferring results from fundamental studies into innovations and finally into functional products. The studies consist of a well-balanced mixture of theoretical and applied knowledge and prepare the student for his/hers career equally well in industry or in academia.

Learning outcomes

- Upon completion of the Minor, the student will be able to:
- Understand the design and fabrication principles of electronic devices
- Rationalize the use of different materials in health care, microsystems and lighting technologies based on their fundamental properties
- Understand the basic design and operation principles of lighting systems
- Understand the basic processes related to product development
- Apply current knowledge to create new solutions for complex systems

Content of the minor

Students may negotiate alternative content up to two courses depending on their Major. Please contact professors Mervi Paulasto-Kröckel and Simo Särkkä for approval of a suggested study plan

Code	Name	Credits	Teaching period
Compulsory courses			
ELEC-E8712	Design for Reliability	5	I-II
ELEC-E8730	Design of Electronic Equipment	5	I-II
ELEC-D8710	Principles of materials science	5	III-IV
ELEC-E5710	Sensors and Measurement Methods	5	IV-V

ELEC minors only for students of ELEC

ELEC minors only for students of ELEC

In the guide, the minors offered by the School of Electrical Engineering (ELEC) have been classified under two headings: ELEC minors for all Aalto students and ELEC minors only for ELEC students.

On the page **ELEC minors for all Aalto students** you can find information about those ELEC minors which are primarily open for all Aalto University students. Please note that some of such minors may, however, be offered only to students of certain majors/departments.

Under **ELEC minors only for ELEC students**, you can find information about those minors which are intended only for students of ELEC.

The more specific target groups of each minor are explained in the descriptions of the minors. The descriptions also provide information on the application procedure and any restrictions regarding applicants.

ELEC minors only for students of ELEC

Minor	Extent (ECTS)	Language of instruction
for aut, it and bioit major students		
Electronics and Electrical Engineering	25	Finnish
for students of ELEC		
International minor	25	

ELEC minors for all students, also for students of ELEC

Minor	Extent (ECTS)	Language of instruction

Minors on B.Sc. level		
Information Technology (IT)	25	Finnish
Bioinformation Technology (BioIT)	25	Finnish
Electronics and Electrical Engineering (EST)	25	Finnish
Automation and Control Engineering (AUT)	25	Finnish
Minors on M.Sc. level		
Acoustics and Audio Technology	20-25	English
Advanced Materials and Photonics	25	English
Biosensing and -electronics	20	English
Communications Engineering	30	English
Control, Robotics and Autonomous Systems	20	English
Electrical Power and Energy Engineering	20	English
Micro- and Nanoelectronic Circuit Design	25	English
Micro and Nanosciences	25	English
Radio Science and Engineering	25	English
Signal, Speech and Language Engineering	20-25	English
Space Science and Technology	25	English
Translational Engineering	20	English

ELEC individual courses for all Aalto students

ELEC individual courses for all Aalto students

Degree students at other Aalto Schools do not need to separately apply for a study right in order to complete courses at the School of Electrical Engineering.

From the pool of enrolled students, participants for the course are chosen according to a prioritizing order defined for the course. If there is such a prioritizing order defined for the course, it is explained in the course description. Before enrolling for the course, check the preliminary requirements at weboodi: https://oodi.aalto.fi/a/frame.jsp?Kieli=6&valittuKieli=6.

You can find the School of Electrical Engineering course listing at weboodi https://oodi.aalto.fi/a/frame.jsp?Kieli=6&valittuKieli=6.

Contact information

School of Electrical Engineering

Planning Officer Annika Salama
annika.salama@aalto.fi
telefon: 050 560 7436

ENG minors for all Aalto students

In the guide, the minors offered by the School of Engineering (ENG) have been classified under two headings: ENG minors for all Aalto students and ENG minors only for ENG students.

On the page **ENG minors for all Aalto students** you can find information about those ENG minors which are primarily open for all Aalto University students. Please note that some of such minors may, however, be offered only to students of certain majors/departments.

The more specific target groups of each minor are explained in the descriptions of the minors. The descriptions also provide information on the application procedure and any restrictions regarding applicants.

ENG minors for all Aalto students

Minor	Extent (ECTS)	Language of instruction
Minors formed from majors		
Energy and Environmental Technology	25	Finnish
Mechanical and Structural Engineering	25	Finnish
Built Environment	25	Finnish
Separate minors		
Computation and Modelling in Engineering	25	English
Aaltonaut	25	English
Intelligent Systems in Engineering	25	Finnish

Computation and Modelling in Engineering

Basic information of the minor

Code: ENG3048

Extent: 25 cr

Language: English

Teacher in charge: Kirsi Virrantaus

Target group: Students who are studying technical sciences. Also students of other schools when prerequisites are fulfilled.

Application procedure: Students who are studying technical sciences are allowed to participate without applying. BIZ- and ARTS-students apply for the minor via internal mobility.

Quotas and restrictions: no

Prerequisites: See WebOodi and/or MyCourses

Name of the minor in other languages:

Content and structure of the minor

Modern design and production in engineering is based on computer assisted tools and processes as well as use of mathematical and statistical optimization and simulation. Computer assisted design (CAD), building information modeling (BIM) and geographic information systems (GIS) as well as finite element (FEM) and solid models are everyday tools in architectural and structural design of buildings and in design of land use and infrastructures of societies. Computational and mathematical methods are applied in computational fluid dynamics (CDF), mechatronics, traffic simulation, research on climate change, urban studies and – just to mention some of the application fields. In mechanical engineering design and manufacturing computer aided engineering is applied in design and analysis of manufacturing plants, equipment and machinery and various kind of vehicles and systems used in transportation, energy field and robotics as well as in fluid mechanics. The computerized tools are based on 3D -models of objects and systems which are used in various analyses and design tasks. Modern complex systems require automatized tools and human decision making in design and todays engineer is expected to understand the principles of these advanced tools. The Minor in Computation and Engineering offers introductory courses to geometric modeling, statistical analysis, and decision support by mathematical and computational aids and tailoring and customizing of software applications. This Minor in Computation and Engineering offers a possibility to extend the Bachelor level studies towards engineering subjects. Computation and Engineering is suggested as a minor for the students who are aiming on Master level to studies in which computer assisted tools or computational and mathematical methods are in core role.

Structure of the minor

If there is some prerequisites they can be found from WebOodi and Noppa.

Code	Name	Credits
MAA-C2005	Geometric Models in Engineering	5
MAA-C3001	Statistical and Stochastic Methods in Engineering	5
ENE-C3002	Models for Decision Support in Engineering	5
YYT-C3002	Application Programming in Engineering	5
RAK-C3002	Project Course on Computational Methods in Engineering	5

Elective courses
You can choose two courses from the table above and replace them with courses from table below so that the Minor will be at least 25 cr.

MS-C2107	Computational Assignments in Applied Mathematics	5
MS-C2105	Introduction of Optimization	5
CS-A1141	Data Structures and Algorithms Y	5
CS-A1150	Databases	5
ICS-C3000	From data to Knowledge	5

Cruise and Ferry Experience

Basic information of the minor

Code: ENG3053

Extent: 10 Mandatory + 10-20 electives

Language: English

Teacher in charge: Pentti Kujala

Target Group: All Aalto's Master students

Application procedure: No

Quotas and restrictions: No

Prerequisites: No

Content and structure of the minor

Cruise & Ferry Experience (CFE) minor provides a holistic approach on creating the passenger ship concept. In modern passenger ships, the design combines the latest business models with the hi-tech solutions and unique architecture. CFE minor is open for all Aalto students and brings talents from different disciplines together already in university education.

The cross-disciplinary CFE minor gives students the overview of the complex systems of passenger ships, cruising experiences, key issues of the unique business. Visiting lectures and mentoring are given by a variety of industry experts from different fields. Learnt issues are deepened and reflected in ship project work, where student groups create concepts for future passenger ships. Topic for the project work is tailored according to group's skills, e.g. from business model development and cruise service design to sustainable manufacturing. Furthermore, in multidisciplinary group working, students learn skills for communication and collaboration between different disciplines.

The CFE minor contains two obligatory courses *Passenger Ship* and *Applied Mechanics Project* from the School of Engineering and the optional courses from other fields in total amount of 20 ECTs or more. The CFE minor students are encouraged to extend their knowledge from the major and choose courses from the other fields of interest. Recommended courses are listed below, but a student can also propose other courses to be included in the CFE minor.

Further information is available from Professor Pentti Kujala (pentti.kujala@aalto.fi)

Structure of the minor

Code	Name	Credits
Mandatory courses		10
MEC-E2003	Passenger Ships L	5
MEC-E1002	Applied Mechanics Project	5

Elective courses		Minimum 20
ENG (School of Engineering, Master programme in Mechanical Engineering)		
MEC-E2003	Passenger Ship L	5
MEC-E2011	Ship Design Portfolio	5
ARTS (School of Art)		
MUO-E3005	User Inspired Design	5
MUO-E3006	Experience Driven Design	5
MUO-E3008	Designing for Services	5
BIZ (School of Business)		
27E02000	Models in Marketing	6
27E20100	Database Marketing	6
30E00300	Productivity and Efficiency Analysis	6
35E00300	Product and Inventory Management	6
35E00400	Coordination of Supply Chains	6
35E08000	Service Business Models	6
37E00100	Information Economy	6
37E00200	Strategic Information Technology Management	6

Earth Observation

Basic information of the minor

Code: ENG3054

Extent: 25 cr

Language: English

Teacher in charge: Miina Rautiainen

Target Group: The minor is open to all master's level students at Aalto University.

Application procedure: None

Quotas and restrictions: No quotas. The minor is targeted only for master's level students.

Prerequisites: In preparing their study plan, the students are required to check that they fulfil the prerequisites for each course i.e. to take the courses in the right order.

Content and structure of the minor.

Earth observation (EO), or the gathering of information about our planet's physical, chemical and biological systems through the analysis electromagnetic data recorded by spaceborne and airborne

instruments, is a rapidly growing discipline. Most environmental issues require global data sets which are only available through satellite instruments. The international expansion of the Earth observation sector urgently calls for engineers who have an understanding of both the design of remote sensing missions and instruments as well as sophisticated skills for interpreting the data collected through the missions. Currently, nearly all university programs in Earth observation in the world focus either on instrumentation or data interpretation, but do not provide a holistic view of both. The minor will bring together Aalto students interested in different aspects of Earth observation and will enable building a cross-disciplinary community within our university. The overall aim is to train Earth observation professionals who are competent in all levels of the chain, from satellite mission engineers to users of remote sensing data in environmental management and decision-making bodies.

Learning outcomes:
The minor focuses on the design of satellite systems and instruments, and the preprocessing and interpretation of satellite remote sensing data. Upon completion of the minor, the student will be familiar with the entire chain of Earth observation, so that he/she

- can formulate the basic physical principles governing the processes in Earth observation in different wavelength domains,
- has a deep understanding of how satellite missions are planned and what are key properties of remote sensing instruments,
- is able to apply versatile methods to preprocess and interpret imaging spectroscopy, multispectral and microwave data and products,
- understands spatial aspects in Earth observation data analysis, and
- is familiar with the future trends and upcoming missions in Earth observation.!

The minor is 25 ECTS and comprises five courses from the list below. Only courses which are not compulsory in the student's MSc program can be included in the minor.

Further information is available from Professor Miina Rautiainen (miina.rautiainen@aalto.fi).

Structure of the minor

Code	Name	Credits
courses		
For students who are not in the Geoinformatics MSc program, at least two courses from the following list:		
GIS-E1020	From measurements to maps	5
GIS-E1030	Introduction to spatial methods	5
GIS-E1040	Photogrammetry, laser scanning and remote sensing	5
courses		
For students in the Geoinformatics MSc program, five courses from the list below. For other students, two or three courses from the list below.		
GIS-E3050	Advanced remote sensing	5
GIS-E5020	GNNS (Global Satellite Navigation System) technologies	5
ELEC-4210	Introduction to space	5
ELEC-4510	Earth observation	5

ELEC-4240	Satellite systems	5
ELEC-4230	Microwave Earth Observation instrumentation	5

Energy Technology

Basic information of the minor

Code: ENG3055

Extent: 25 cr

Language: English

Teacher in charge: Martti Larmi

Target Group: Students from other Master's Programmes at Aalto

Application procedure: No

Quotas and restrictions: No

Prerequisites: Prerequisites: Basics of Thermodynamics (ENY-C2001 Thermodynamics and Heat Transfer (5 cr) or equivalent knowledge) and Basics of Chemistry (CHEM-A1250 Principles of Chemistry (5 cr) or equivalent knowledge)

Content and structure of the minor

The Energy Technology Minor offers students good overall knowledge within the field of energy technology as well as further specialization opportunities in three subject areas, which are Heat and Power Processes, Energy Systems for Industry and Communities and Building Energy and HVAC Technology. Altogether, the program covers the most common energy conversion technologies, bioenergy and environmental issues, the end use of energy, energy economics, and issues related to improvement of energy efficiency in the industry and communities.

Recommended Course Packages
Basically, the student can pick up any courses from the Master's Programme of Energy Technology to create his/her minor. However, the following course packages are recommended.

Further information is available from Professor Martti Larmi (martti.larmi@aalto.fi).

Structure of the minor

Package 1: Energy Systems for Industry and Communities, 25cr

Code	Name	Credits
Common studies (select 10 cr)		
EEN-E1010	Power Plant and Processes	5
EEN-E1020	Heat Transfer	5

EEN-E1050	Renewable Energy for Communities and Industry	5
Advanced studies (select 15cr)		
EEN-E3001	Fundamentals of Industrial Energy Engineering	5
EEN-E3003	Industrial Drying and Evaporation Processes	5
EEN-E3004	District Heating and Cooling	5
EEN-E3006	Energy Markets	5
EEN-E3007	Process Integration and Optimization of Energy Systems	5
EEN-E9010	Energy Project	5

Contact person who gives more information Henrik Holmberg (Henrik.Holmberg@aalto.fi)

Package 2: HVAC Technology, 25cr

Code	Name	Credits
Common studies (select 10 cr)		
EEN-E1020	Heat Transfer	5
EEN-E1030	Thermodynamics in Energy Technology	5
EEN-E1040	Measurement and Control of Energy Systems	5
Advanced studies (select 15cr)		
EEN-E4001	Comfort and Healthy Indoor Environments	5
EEN-E4002	Heating and Cooling Systems	5
EEN-E4003	Ventilation and Air-Conditioning Systems	5
EEN-E4005	Fundamentals of HVAC design	5
EEN-E4006	Advanced HVAC design	5

Contact person who gives more information Kari Alanne (Kari.Alanne@aalto.fi)

Package 3: Bioenergy, 25cr

Code	Name	Credits
Common studies (select 10 cr)		
EEN-E1010	Power Plant and Processes	
EEN-E1050	Renewable Energy for Communities and Industry	
Advanced studies (select 15 cr)		
EEN-E2002	Combustion Technology	
EEN-E2003	Combustion	
EEN-E2005	Bioenergy1	
EEN-E2006	Bioenergy2	
EEN-E2007	Energy, Environment and Emission Control	

EEN-E3006	Energy Markets
EEN-E9010	Energy Project

Contact person who gives more information the Package 3 is Loay Saeed (Loay.Saeed@aalto.fi)

Geoengineering and Mineral Based Materials

Basic information of the minor

Code: ENG3056

Extent: Minimun 20 cr

Language: English

Teacher in charge: Mikael Rinne

Target Group: Exchange students and Aalto University master students, especially from Aalto ENG and Aalto CHEM.

Application procedure: To be submitted to the head of the program, prof. Mikael Rinne.

Quotas and restrictions: 10 students. The applicant must have Bachelor degree in a relevant engineering program. Relevant program depends on the course portfolio the student aim to complete.

Prerequisites: Bachelor degree in a relevant engineering program.

Content and structure of the minor

Motivation
Geoengineering is subject which is essential part of the competence for many professionals working in the field of Civil and Mining Engineering. For example, structural engineers need to understand the behavior of the foundation when they are planning buildings, bridges and other demanding structures. Good knowledge of construction methods and structures built in soil and rock is also valuable for professionals in water and road engineering. Also students focusing in Mining or Mineral Resource Engineering will have great benefit of this program.

Intended learning outcomes

After the completion of the course the student

- can describe the basic geological processes and characteristics of soil and rock
- has the basic knowledge of the most commonly used mineral based materials in building technology
- understands the principles of soil and rock behavior and interaction with associated structures

- can make simple design of geotechnical structures
- can describe the basic construction techniques and equipment applied in geoengineering
- recognize the environmental effects of geoengineering and the life time performance of geotechnical structures

Structure of the minor

Code	Name	Credits
Common studies (Compulsory courses)		15
GEO-E1010	Engineering Geology	5
GEO-E1020	Geotechnics	5
GEO-E1040	Rock Excavations	5
Advanced studies, select one to three courses		5-15
Choose so many courses below that the Minor will be at least 20 cr		
GEO-E2010	Advanced Soil Mechanics L	5
CIV-E1010	Building Materials Technology	5
GEO-E3010	Economic Geology and Mineral Economics L	5
CIV-E2030	Experimental Methods in Building Material Technology L	5
GEO-E1050	Finite Element Methods	5
GEO-E2080	Foundation Engineering and Ground Improvement	5
GEO-E3040	Geometric Design of Roads	5
GEO-E2020	Numerical Methods in Geotechnics L	5
GEO-E2090	Project Course in Geoengineering	5
GEO-E2030	Rock Mechanics L	5
GEO-E1030	Structural Design of Roads	5

Examples of course packages for some areas of interest

Minor in Geoengineering and mineral based materials
Common studies (15 cr., mandatory)
Engineering Geology (5 cr.)
Geotechnics (5 cr.)
Rock Excavations (5 cr.)

Advanced studies (15 cr.,
elective)
Select 3 courses from the table below. Suggestions are given according to your area of interest.

Geomaterials	**Geotechnical**	**Highway Engineering**	**Rock Engineering, Mining and Mineral Resource Engineering**

	Building Materials Technology		
Experimental Methods in Building Material Technology	Advanced Soil Mechanics	Structural Design of Roads	Rock Mechanics
Economic Geology and Mineral Economics	Foundation Engineering and Ground Improvement	Geometric Design of Roads	Economic Geology and Mineral Economics
Finite Element Method	Finite Element Method	Foundation Engineering and Ground Improvement	Foundation Engineering and Ground Improvement
	Project course in Geoengineering		

Geoinformatics

Basic information of the minor

Code: ENG3057

Extent: 25 cr

Language: English

Teacher in charge: Henrik Haggren

Target Group: The minor is open to all master's level students at Aalto University.

Application procedure: None

Quotas and restrictions: No

Prerequisites: The students are required to check in WebOodi that they fulfil the prerequisites for each course. In preparing their study plan, the students are required to check that they fulfil the prerequisites for each course i.e. to take the courses in the right order.

Content and structure of the minor

Background:

Global issues, such as distribution of natural and water resources, urban development and sprawl, security and energy needs all involve a significant spatial component. These issues offer fascinating challenges for geoinformatics experts who can measure and handle huge data volumes and analysis of complex geospatial problems. Geoinformatics (GIS) is a truly multidisciplinary discipline: the research and applications comprise a wide range of themes from local to global scales, and from human-centered to natural environments. The rapid expansion of geo-technologies from GIS experts to the global public has created a wide job market for geoinformatics professionals.

Learning outcomes:

Upon completion of the Minor in Geoinformatics, the student can apply the methods and processes in
spatial data acquisition. The student can manage geoinformation and create cartographic products and also organize the use of spatial data in various problem solving and decision support situations. The student understands and can apply spatial data management tools, spatial algorithms and relevant software. Understanding user requirements as well as assessment of uncertainty, accuracy and reliability concerning geo data, methods and processes are other key learning outcomes.

The minor will be 25 ECTS and will comprise five courses (each 5 ECTS) from the lists below.

Structure of the minor

Code	Name	Credits
A. One compulsory course for all students taking this minor:		
GIS-E1020	From measurements to maps	5
B. One or two courses from the following list:		
GIS-E1030	Introduction to spatial methods	5
GIS-E1040	Photogrammetry, laser scanning and remote sensing	5
GIS-E1050	Visualization of Geographic Information	
GIS-E1010	Geodesy and Positioning	
C. Two or three courses from the following list:		
GIS-E1060	Spatial Analytics	5
GIS-E4020	Advanced spatial analytics	5
GIS-E4010	Topographic Information Management	5
GIS-E3020	Digital Image Processing and Feature Extraction	5
GIS-E3010	Least-Squares Methods in Geoscience	5
GIS-E3040	Advanced Photogrammetry	5
GIS-E3030	Advanced Laser Scanning	5
GIS-E3050	Advanced remote sensing	5
GIS-E5020	GNNS (Global Satellite Navigation System) technologies	5
GIS-E5010	Earth System Geodesy	5

Contact person: Professor Henrik Haggren (henrik.haggren@aalto.fi)

Industrial Internet

Basic information of the minor

Code: ENG3058

Extent: 25 cr

Language: English

Teacher in charge: Petri Kuosmanen

Target Group: Industrial Internet -minor is suitable to all Aalto Master's degree students, but is primarily targeted to ENG, ELEC, CHEM and SCI –school students.

Application procedure: To be submitted to the head of the program.

Quotas and restrictions: During the first year there will be maximum of 25 students.

Prerequisites: The applicant must have Bachelor degree in a relevant engineering program. The students are required to check that they fulfil the prerequisites for each course.

Content and structure of the minor

Background:
The concept of "Industrial Internet" has recently emerged as a topic of considerable attention in the industry both internationally and in Finland. While covering other well-known themes such as "Internet of Things" and "Cyber-Physical Systems", the level of ambition of the concept has been raised to no less than changing profoundly how the manufacturing industries base their operations to ICT by exploiting novel technologies such as sensors, actuators, wireless networks, clouds, computational modeling and simulation, and mobile user interfaces - in short, bringing manufacturing industries and their ecosystems truly to Internet age.

Industrial internet encompasses the application of information and communications technology in industry and within society for improving the efficiency of operations and the creation of new added value for customers and users. Internet and mobile technologies have changed to become generally and easily available tools with which it is ever simpler and cheaper to develop applications. Through their use, the industrial internet enables new industrial and service businesses by linking intelligent devices, and the people that use them, to analysis and decision making.

Learning outcome:
Having completed the Industrial Internet minor the student understands utilization of data as a source of innovation for added value. The student understands the business potential associated with the collected information as well as risks and responsibilities. The student is able to define Industrial Internet as part of the organizational strategy and is able to recognize the required competencies. The student understands the possibilities Industrial Internet creates for productivity improvement. In addition the student is able to operate effectively in a rapidly changing environment.

Content:
The minor is provided as joint activity of ENG, ELEC and SCI -schools. Each school offers courses of their special competence areas within the multidisciplinary scope of Industrial Internet.

Further information is available from Professor Petri Kuosmanen (petri.kuosmmanen@aalto.fi)

Structure of the minor

Code	Name	Credits
Student selects 20 – 30 credits of the following courses:		
CS-5340	Introduction to Industrial Internet	5
CS-E5360	Systems of Systems	5
CS-E5320	Seminar on Enterprise Information Systems	5
T-106.5300	Embedded Systems	5
KON-41.4160	Mechatronics project	10
ELEC-E8001	Embedded Real-Time Systems	5
ELEC-E8408	Embedded Systems Development	5
ELEC-A7100	C-ohjelmoinnin peruskurssi	5
ELEC-A7150	C++ Programming	5
ELEC-A7240	Internet tekniikat	5
ELEC-A7310	Sovellusohjelmointi	5
ELEC-A7470	Cybersecurity	5
ELEC-E3530	Digital Microelectonics I	5

Marine-IT

Basic information of the minor

Code: ENG3059

Extent: 25 cr

Language: English

Teacher in charge: Pentti Kujala

Target Group: Students interested in linking ship design and operation with advanced automation and IT technology, so either background in marine technology, or automation or IT technology is a good starting point.

Application procedure: No

Quotas and restrictions: No

Prerequisites: Basic course of programming

Content and structure of the minor

Digitalisation, Big Data, Industrial Internet, Automation, Smart Ships, Unmanned ships etc. are the future hot topics also in marine sector. This will require new type of education program so that the future experts and leaders in this field have a good overview how the Marine and IT sector can be the best way integrated. Therefore, the Marine-IT minor brings different disciplines together already

in university education and it is open for all Aalto students. The cross-disciplinary Marine-IT minor gives students the overview of the ship design and operation principles together with the basic information of the possible IT tools that can be applied in marine sector.

To get the minor you should select at least 5 courses from the master level courses shown below. In addition, the IT courses require some background courses at the bachelor level as indicated also below. This minor is suitable for both marine technology major students as well as IT students interested to join these two disciplines.

Structure of the minor

Code	Name	Credits
Recommended course selection		
ENG (School of Engineering, Master programme in Mechanical Engineering)		
Master level		
MEC-E2003	Passenger Ship L	5
MEC-E1002	Applied Mechanics	5
MEC-E2011	Ship Design Portfolio	5
MEC-E2009	Marine risks and safety L	5
MEC-E2005	Ship systems	5
SCI (School of Science)		
Bachelor level courses for background (in Finnish)		
CS-A1141	Tietorakenteet ja algoritmit	5
CS-A1121	Ohjelmoinnin peruskurssi Y2	5
CS-A1111	Ohjelmoinnin peruskurssi Y1	5
Master level		
CS-C3140	Operating Systems	
CS-C3170	Web Software Development	
CS-C3130	Information Security	
CS-C3100	Computer Graphics	
CS-E3190	Principles of Algorithmic Techniques	
CS-E3200	Discrete Models and Search	
CS-E3210	Machine Learning: Basic Principles	
ELEC-E7850	User Interfaces	

Contact person: Professor Pentti Kujala (pentti.kujala@aalto.fi)

Mechanical Engineering

Basic information of the minor

Code: ENG3060

Extent: 20-30 cr

Language: English

Teacher in charge: Sven Bossuyt

Target Group: The Mechanical Engineering M.Sc. level minor is offered primarily for the master's degree students of the CHEM, SCI and ELEC schools.

Application procedure: No

Quotas and restrictions: No

Prerequisites: Student must take into account any course prerequisites and the structure of studies in their own programme, to form a minor of 20 to 30 cr.

Content and structure of the minor

Students may freely choose a combination of suitable technical courses offered as common studies or advanced studies in Mechanical Engineering, taking into account any course prerequisites and the structure of studies in their own programme, to form a minor of 20 to 30 cr.

The minor may consist entirely of courses offered as common studies. The "Mechanical Engineering in Society" course and the project courses offered as common studies are not suitable for the minor. The minor may include not more than one of the "Societal perspectives in engineering" courses.

Learning outcomes:

In Mechanical Engineering minor studies, students select Mechanical Engineering common studies and may combine them with more specialised courses in the fields of arctic technology, engineering materials, marine technology, mechatronics, product development, production engineering, solid mechanics or a combination of these. Specialising provides the student with more detailed knowledge of the current methods and applications in the field, as well as some knowledge of recent research and developments.
The student knows how to solve engineering problems in their chosen area, and correctly applies a combination of creativity, systematic analysis, computational tools, and critical judgement to such tasks. The student justifies their choices and methods, communicates clearly and collaborates effectively. The student can articulate how their own unique professional profile equips them to contribute productively in any setting.

Further information is available from Professor Sven Bossuyt (sven.bossuyt@aalto.fi)

Structure of the minor

Aaltonaut

Basic information of the minor

Code: ENG3049

Extent: 25 cr

Language: English

Teacher in charge: Kalevi Ekman

Target Group: All Aalto's Bachelor students

Application procedure: The selection process is primarily based on a motivation letter. However, possible interviews may be held amongst students with equally competent motivation letters.

Quotas and restrictions: 35 students

Prerequisites: no

Content and structure of the minor

Aaltonaut is an interdisciplinary minor subject aimed at Bachelor's level students. The studies will be taught partly in English. Although the minor subject 25 credits can be made up of Aaltonaut courses, the study plan also allows for some flexibility and course options to supplement the offering. In addition to the Aaltonaut minor subject, Aaltonaut students are offered integrated language and communications studies, internship possibilities, exchange studies and an interdisciplinary Bachelor's seminar (up to 50 credits).

Realisation of Aaltonaut courses is based on inquiry- and problem-based learning as well as group work in interdisciplinary groups. The aim is to supplement academic study guidance with working life mentoring. Students who have completed the minor subject will have a command of the basic of product development, business and scientific research, as applicable. The general coaching goals of the minor subject are reinforcing an entrepreneurial attitude and refining teamwork and communication skills. The desired Aaltonaut characteristics are curiosity, courage, initiative and the ability to take action.

We believe that completing the Aaltonaut minor subject will make the graduating Bachelors more attractive when competing for positions in Master's degree programmes and entering working life. 35 first or second year students of Aalto University will be selected to start their Aaltonaut studies this fall (see http://aaltonaut.fi/apply/). The student selection process is based on a motivation letter, preferably written in English. Interviews will be organized within students with the same competence, and this should be taken into account during the selection process. All accepted students will be invited to the Bootcamp, which is a launch-off weekend session in the end of October.

Further information is available from Professor Kalevi Ekman (kalevi.ekman@aalto.fi) and Elina Kähkönen (elina.kahkonen@aalto.fi) (and aaltonaut.fi).

Structure of the minor

Code	Name	Credits
Mandatory courses		15
AAN-C1003	Professional Development	5
AAN-C2006	Product Analysis	5

AAN-C2009	Designing an Electronic Device for Business and Production	5
Elective courses		10
Choose so many courses below that the Minor will be at least 25 cr		
AAN-A1001	Entrepreneurship in Aalto	1
AAN-C1002	Challence Breakers	5
AAN-C2003	ADD BASICS: Working in the Digital Paradigm	5
AAN-C2007	Product Sustainability	5
AAN-C2008	Research Project V	5-10

ENG minors only for students of ENG

ENG minors only for students of ENG

In the guide, the ENG minors have been classified under two headings: ENG minors for all Aalto students and ENG minors only for ENG students.

On the page ENG **minors for all Aalto students** you can find information about those ENG minors which are primarily open for all Aalto University students. Please note that some of such minors may, however, be offered only to students of certain majors/departments.

Under ENG **minors only for ENG students**, you can find information about those minors which are intended only for students of ENG.

The more specific target groups of each minor are explained in the descriptions of the minors. The descriptions also provide information on the application procedure and any restrictions regarding applicants.

ENG minors only for students of ENG

Minor	Extent (ECTS)	Language of instruction
Individual Minor Subject	20-25	According to agreement
International Studies Minor	20-25	According to agreement
Minor completed at a Finnish University	20-25	According to agreement
Minor completed at a University Abroad	20-25	According to agreement

Individual Minor Subject

Basic information of the minor

Code: SCI3040

Extent: 20-25 cr

Language: According to agreement

Professor in charge:

- Bachelor’s degree: Professors in charge of the majors
- Master’s degree: Directors of the degree programmes

Target group: Students of the School of Science

Quotas and restrictions: Only for students studying in the new degree structure.

Name of the minor in other languages: Henkilökohtainen sivuaine, Personligt biämne

Content and structure of the minor

Individual Minor Subject is targeted mainly for students who change their study right from the old degree structure (2005 degree regulations) to the new degree structure (2013 degree regulations) and who have already completed courses from a minor which is not offered anymore in the new degree structure.

Individual Minor Subject can be accepted in student’s personal study plan only with good grounds. The courses included in the minor need to create a clear entity, which can be easily named. In the Bachelor’s degree, the professor in charge of the major accepts the minor. In Master’s degree, the director of the programme accepts the minor.

Usually the minor is chosen among minors confirmed in Aalto University, done abroad during student exchange or done in another Finnish university.

International Studies Minor

Basic information of the minor

Code: ENG3052

Extent: 25-30 cr

Language: According to agreement

Professor in charge: Director of your Master's programme

Target group: Master’s degree students at Aalto ENG studying in one of the new Master’s programmes (starting in Autumn term 2016)

Quotas and restrictions: Only for students studying in the new degree structure.

Content and structure of the minor

Content

Studies are completed entirely or mainly in an international partner university abroad. The minor includes relevant course studies for the student’s MSc (Tech) degree. Besides the substance studies,

also foreign language and cultural studies and a credit for international students' tutoring at Aalto can be included to the minor. The study plan and the content of the international minor have to be agreed beforehand with the Programme Director in question. Also possible changes to the study plan have to be approved.
International minor can replace the elective studies in the student's MSc (Tech) degree. The principles of the student exchange apply.

Learning outcomes: Students

- Learn about studying their field of study in a foreign university and environment
- Gain different and global perspective to their field of study
- Learn/improve their foreign language skills
- Gain understanding about intercultural communications and multiculturalism
- Learn to tolerate uncertainty
- Learn to solve problems in a foreign environment
- Learn cultural sensitivity
- Gain networking skills

ENG individual courses for all Aalto students

ENG individual courses for all Aalto students

Degree students at other Aalto Schools do not need to separately apply for a study right in order to complete courses at the School of Engineering.

From the pool of enrolled students, participants for the course are chosen according to a prioritizing order defined for the course. If there is such a prioritizing order defined for the course, it is explained in the course description. Before enrolling for the course, check the preliminary requirements at weboodi: https://oodi.aalto.fi/a/frame.jsp?Kieli=6&valittuKieli=6.

You can find the School of Engineering course listing at
weboodi https://oodi.aalto.fi/a/frame.jsp?Kieli=6&valittuKieli=6.

Contact information

School of Engineering

Study co-ordinator Virpi Riissanen
virpi.riissanen@aalto.fi
tel. 050 564 5495

SCI minors for all Aalto students

In the guide, the minors offered by the School of Science (SCI) have been classified under two headings: SCI minors for all Aalto students and SCI minors only for SCI students.

On the page **SCI minors for all Aalto students** you can find information about those SCI minors which are primarily open for all Aalto University students. Please note that some of such minors may, however, be offered only to students of certain majors/departments.

Under **SCI minors only for SCI students**, you can find information about those minors which are intended only for students of SCI.

The more specific target groups of each minor are explained in the descriptions of the minors. The descriptions also provide information on the possible application procedure and any restrictions regarding applicants.

SCI minors for all Aalto students

Minor	Extent (ECTS)	Language of instruction
Bachelor’s Level Minors		
Advanced Energy Systems	25	Finnish
Information Networks	25	Finnish
Mathematics	20–25	Finnish
Statistics	20-25	Finnish and English
Systems Sciences	25	Finnish
Engineering Physics	20-25	Finnish
Computer Science and Engineering	25	Finnish
Industrial Engineering and Management	25	Finnish
Master's Level Minors		
Aalto Nuclear Safety	25	Finnish and English
Aalto Ventures Program Minor (AVP)	20-25	English
Analytics and Data Science	22-24	English
Bioinformatics	25	English
Biomedical Engineering	25	English
Complex Systems	25	English
Computer Science	20-25	English
Engineering Physics	25	English
Human Neuroscience and -technology	20	English
Leadership and Knowledge Management	20-25	English
Machine Learning and Data Mining	20-25	English
Mathematics	20-25	English
Mobile Computing, Services and Security	20-25	English
Multi-Disciplinary Energy Studies (MES)	20-25	English

Operations and Service Management	20-25	English
Software and Service Engineering	20-25	English
Strategy and Venturing	20-25	English
Systems and Operations Research	20-25	English
USchool	20-25	Finnish and English

Multi-Disciplinary Energy Studies

Basic information of the minor

Code: SCI3038

Extent: 20-25 cr

Language: English

Professor in charge: Peter Lund

Target group: The MES minor is offered to all Aalto University master's students, in particular from the School of Science. International students are welcomed.

Application procedure: See detailed information at the end of the description.

Quotas and restrictions: No quotas. The minor is targeted only for master students.

Prerequisites: No prerequisites.

Content and structure of the minor

Goal

The goal of Aalto's Multi-Disciplinary Energy Studies minor is to educate multi-skilled students with both subject-specific know-how and integrative understanding across a range of energy issues.

Scope

Energy is one of mankind's grand challenges linked to climate change, human development, sustainability, economy, and innovations, among others. Understanding energy and its different facets requires strong systemic thinking and multiple skills.

The Multi-Disciplinary Energy Studies (MES) is an elective minor for Aalto University master's students interested in energy and society. It is run by the Aalto University School of Science's Energy Initiative http://energyscience.aalto.fi/en/) on Otaniemi Campus in Espoo, in collaboration with other Aalto schools. MES offers a multidimensional view on energy, to understand the complexity of energy in new ways. It combines key subjects in science and engineering, economics

and business, social sciences and human behaviour. Offering an integrative approach to create solutions in energy, MES is open to students of different disciplines.

The MES minor deals with topical energy themes such as sustainable energy, energy frugality, green-ICT, energy markets, carbon markets, green business, green innovations, human behaviour and energy, smart power, E-mobility, among others.

Collaboration

The Multi-Disciplinary Energy Studies (MES) is a collaborative teaching effort between several disciplines of Aalto University, as follows: system analysis (Prof. Ahti Salo), media (Prof. Lily Diaz-Kommonen), energy sciences (Prof. Peter Lund), information technology (Prof. Antti Ylä-Jääski, Prof. Keijo Heljanko, Prof. Jukka Nurminen), business (Profs. Karlos Artto, Jan Holmström), economics (Prof. Matti Liski).

Structure

The Multi-Disciplinary Energy covers key perspectives on energy issues: science and technology, economics and business, social sciences and human behaviour. All students familiarize themselves with each of these three core domains.

The MES minor has a 2-level structure, as follows:

Level 1

- Introduction to energy, multi-disciplinary issues, approaches, cases and tools
- **All students will participate in the multi-disciplinary energy introduction course**

Level 2

- Introduction to energy & society, trends, transitions, sustainability; energy efficiency
- Deepening understanding of economics and business, social sciences and/or human behaviour while applying these to sustainable energy
- **Students need to cover at least two out of the three perspectives**

Due to the multi-disciplinary character, students are encouraged to discuss the detailed contents of courses to be included in the MES minor with the professors in charge.

The extent of the MES minor is 20-25 credits. The MES minor contents are the following:

Code	Name	Credits	Period
Level 1 Core course (5 cr) :			
Compulsory course to all students; input from several disciplines jointly. Each collaborator provides a 2-4 h introductory lecture to energy from their own perspective			
PHYS-C1380	Multi-disciplinary energy perspectives	5	III-IV
Level 2 Supportive courses (15-20 cr):			
Students will choose one of the two following energy specific courses:			

CS-E4002	Special Course in Computer Science	1-10	
PHYS-C6370	Fundamentals of New Energy Sources	5	I-II

Students will choose courses from the list below: 5-10 credits per perspective (S&T, economics &business, social &behavior), with some energy relevant dimension, in total 10-15 cr.

CS-E4002	Special Course in Computer Science	1-10	
CS-E4100	Mobile Cloud Computing	5	I-II
MS-E2117	Riskianalyysi/Risk Analysis	5	III-IV
MS-E2136	Special Topics in Decision Making	3-6	
PHYS-C6370	Fundamentals of New Energy Sources	5	I-II
PHYS-E0483	Advances in New Energy Technologies	5	III-IV
PHYS-E0581	Individual Studies	1-10	I, II, III, IV, V
TU-E2030	Advanced Project-based Management	3-5	I-II
TU-E2010	Industrial Service Operations	3-6	I
31C01300	Energy and Environmental Economics	6	V (The course has only limited number of places for students of the minor.)
31E01800	Resource and Environmental Economics	6	(The course has only limited number of places for students of the minor.)
DOM-E5103	Topics in Visualization and Cultural Analytics	3-6	III (The course has only limited number of places for students of the minor.)

Applying to the Multi-Disciplinary Energy Studies minor

You can apply for the master's level Multi-Disciplinary Energy Studies minor at any time. The applications are dealt with at the end of each month.

Instructions on how to apply:

- Send your contact information, approved personal study plan (HOPS) including Multi-Disciplinary Energy Studies, transcript of records and motivation letter via email to laura.ohrnberg@aalto.fi.
- Include the list of courses which you intend to include in the Multi-Disciplinary Energy Studies, selected from the list above.

Please note the following:

- Aalto students from other schools than the one organising a given course, need to apply to the courses of the School of Business (31C01300 and 31E01800) and those the School of Arts, Design and Architecture (DOM-E5103), while they may freely choose courses offered by their own school. Please see instructions on how to apply to courses.
- Other courses are open for Aalto University's students to register via WebOodi.
- Students should include courses of at least two out of the three perspectives of the MES minor.

Registered Multi-Disciplinary Energy Studies students are given preference in admission to the BIZ and ARTS courses. However, minor does not guarantee that students are admitted to all courses that are part of their study plan. Students also need to register to each individual course separately in WebOodi. Different courses have different application procedures and deadlines so read the course web pages carefully.

Please contact the planning officer or study secretary of your degree programme to make sure that they approve including Multi-Disciplinary Energy Studies minor in your study plan and your degree. Each student is personally responsible for obtaining this approval.

Statistics

Code: SCI3063

Extent: 20-25 cr

Language: Finnish and English

Teacher in charge: Pauliina Ilmonen

Target group: All students of Aalto University with sufficient prerequisite knowledge.

Application procedure: The minor is open for all students of Aalto University.

Quotas and restrictions: No quotas or restrictions.

Prerequisites: Basic courses in mathematics MS-A000X, MS-A010X, MS-A050X or comparable skills.

Name of the minor in other languages: Tilastotiede, Statistik

Content and structure of the minor

As more and more data are collected, stored and analyzed, knowledge of statistical methods has become increasingly important in many disciplines. Understanding statistics is useful for research in many areas including engineering, business, and education as well as in many jobs in industry and public administration. The minor in statistics is designed to provide students with an introduction to

both -- statistical theory and practice. The students will learn to collect and describe data, to conduct statistical analyses and to interpret the results. Additionally, the students will learn to perform computer-based analyses and the theory behind the used methods.

Structure of the minor

The Statistics minor is aimed for students who do not have Mathematics and Systems Sciences as their major. The students agree on the content of the minor (20-25 cr) with Professor Pauliina Ilmonen. The minor can include, for example, the following courses:

CODE	NAME	CREDITS	PERIOD
MS-C2104	Introduction to Statistical Inference	5	III-IV
MS-C2111	Stokastiset prosessit	5	I
MS-C2128	Ennustaminen ja aikasarja-analyysi	5	II
MS-E2112	Multivariate Statistical Analysis	5	III-IV

Additional special courses in the field of the minor are taught in English under the name “Course with varying content”. These courses can also be included in the minor.

Aalto Nuclear Safety

Code: SCI3074

Extent: 25 cr

Language: English / Finnish

Teacher in charge: Filip Tuomisto

Target group: The ANS minor is offered to all master-level students of the Aalto University schools of technology (SCI, ENG, ELEC, CHEM). International students are welcome.

Application procedure: See detailed information at the end of the description.

Quotas and restrictions: No quotas. The minor is targeted only for master students.

Prerequisites: BSc in science or engineering

Content and structure of the minor

Goal

The goal of the Aalto Nuclear Safety minor is to provide the student with a multidisciplinary view on nuclear safety from the engineering perspective both in national and international contexts.

Scope

Finland and the EU are strongly committed to the safe and efficient use of nuclear energy as a part of targeting carbon-neutral society. Depending on the progress of the ongoing and planned projects, the need for personnel with higher education in the nuclear energy sector in Finland is 1200 – 2400 people during 2015 – 2025.

The Aalto Nuclear Safety minor (ANS) is an elective minor for students of the Aalto University schools of technology (School of Science, School of Engineering, School of Chemical Technology, School of Electrical Engineering). It is run by the Aalto Nuclear Innovation and Safety program that joins the efforts across schools (http://www.aalto.fi/en/research/platforms/energy/studies/ #nuclear_program). Studies in the minor are tailored for each student to complement their major studies in the most effective way. The main goal is to provide the student with complementary knowledge on the specific issues related to nuclear energy and nuclear safety in other engineering disciplines than those of the major.

Collaboration

The minor is organised in close collaboration between the schools of technology. The contact persons for each school are: Prof. Filip Tuomisto (SCI), Prof. Sanna Syri (ENG), Prof. Simo-Pekka Hannula (CHEM), Prof. Liisa Haarla (ELEC).

In the national context, selected courses provided by Lappeenranta University of Technology and the Laboratory of Radiochemistry of the University of Helsinki can be included in the minor (see details below). Internationally, students in the minor can take courses available through the European Nuclear Education Network ENEN (http://www.enen-assoc.org). An additional benefit provided by ENEN is the European Master of Science in Nuclear Engineering Certification EMSNE (requires a 300 ECTS-MSc-level degree where 60 ECTS are in nuclear sciences and technology, preferably engineering including a MSc thesis project in the nuclear field, and 20 ECTS need to be earned in a country other than that of the home university).

Structure of the minor

The ANS minor has a two-level structure. The first part contains two courses common to all students. The credits for the portfolio can be awarded only after all the other courses towards the minor have been passed.

The second part consists of courses provided by several MSc programmes. The students will choose 19-24 credits from the course list, so as to meet the required extent of 25 cr. Note that individual courses may have special prerequisites, group size limits and separate application procedures. The course list needs to be agreed on with the professor in charge of the ANS minor. Also other nuclear-relevant courses may be included, as agreed on with the professor in charge of the ANS minor.

Code	Name	Credits	Period
Compulsory courses		6	

PHYS-C6360 *	Johdatus ydinenergiatekniikkaan	5	III-IV
PHYS-E0564	Nuclear competence portfolio	1	I-V

* If this course or equivalent knowledge has already been included in the BSc degree (in the latter case approval of the professor in charge of the ANS minor required), there is no need for replacement courses. If needed, the course can be passed in English through individual assignments.

Elective courses

Choose courses from the following list until the minimum requirement of 25 cr is met.

Physics-oriented courses:

PHYS-C0360	Säteilyfysiikka ja -turvallisuus	5	I-II
PHYS-E0460	Reaktorifysiikan perusteet	5	I-II
PHYS-E0463	Fusion Energy Technology	5	III-IV
PHYS-E0562	Nuclear Engineering, advanced course	5	IV-V
PHYS-E0563	Fundamentals of Plasma Physics for Space and Fusion Applications	5	III-V
PHYS-E0544	Individual Studies in Physics	1-10 (content to be agreed separately)	I, II, III, IV

Organization and systems -oriented courses:

TU-E3150	Safety Management in Complex Sociotechnical Systems	5	IV-V
TU-E3020	Knowledge Management in Practice	5	I-II
TU-E3030	Collaboration in Networks	5	I-II
MS-E2117	Riskianalyysi	5	III-IV
CS-E4520	Computer-Aided Verification and Synthesis	5	III-IV
ELEC-C1230	Säätötekniikka	5	III-IV
ELEC-E8110	Automation Software Synthesis and Analysis	5	

Engineering-oriented courses:

ENY-C2001	Termodynamiikka ja lämmönsiirto	5	I-II
EEN-E1020	Heat transfer	5	II
EEN-E2001	Computational Fluid Dynamics	5	III
EEN-E3006	Energy Markets	5	I
CIV-E3050	Fire dynamics and simulation	5	III
ELEC-C6001	Sähköenergiatekniikka	5	IV-V
ELEC-E8413	Power Systems	5	I-II
ELEC-E8406	Electricity Distribution and Markets	5	III-IV
CHEM-E5215	Materials for Nuclear Power Plants	5	III-IV

Suitable courses from other Finnish universities (available through the flexible study right (JOO) if the school of the student approves the JOO application) are listed in the following. Note that individual courses may have special prerequisites, group size limits and separate application procedures.

Code	Name	Credits
Thermal hydraulics, Lappeenranta University of Technology:		
BH30A1900	Thermal Hydraulics of Nuclear Power Plants	3
BH30A2000	Modelling of Thermal Hydraulics of Nuclear Power Plants	3
BH30A2200	Experimental Nuclear Thermal Hydraulics	3
Radiochemistry, University of Helsinki:		
55733	Chemistry and Analysis of Radionuclides	7
55741	Chemistry of the Nuclear Fuel Cycle	3
55745	Chemistry of the Final Disposal of Spent Nuclear Fuel	3

Suitable courses from ENEN members (international studies) are agreed on separately.

Applying to the Aalto Nuclear Safety Minor

You can apply to the Aalto Nuclear Safety minor (master level) at any time.

Instructions on how to apply:

1. Add the ANS minor to your Personal Study Plan (HOPS).

2. Contact the professor of your major or the planning officer of your degree programme to make sure that they approve including ANS in your personal study plan and your degree.

3. Send your study plan as a PDF-file via email to the professor in charge of ANS and agree on a short face-to-face discussion about the study plan.

4. Apply/register for each individual course separately. Different courses have different application procedures and deadlines so read the course web pages carefully.

Please note the following:

ANS does NOT guarantee that you are admitted on all courses that are part of your study plan. Always contact your degree programme staff or your professor to make sure that they approve including ANS in your study plan and your degree. Each student is personally responsible for obtaining this approval.

Aalto Ventures Program Minor

Basic information of the minor

Code: SCI3019

Extent: 20-25 cr

Language: English

Teacher in charge: Marina Biniari, Mikko Jääskeläinen

Target group: All master's students of Aalto University.

Application procedure: Instructions for AVP student registration, please see: http://avp.aalto.fi/courses/

Quotas and restrictions: No quotas. The minor is targeted only for master students.

Prerequisites: No prerequisites.

Content and structure of the minor

Students from all six schools of Aalto University are welcome to take Aalto Venture Program (AVP) minor or take AVP and other entrepreneurship courses as electives. AVP courses provide Aalto Master's students with diverse steps into entrepreneurship. AVP courses cover important aspects of entrepreneurship; leadership, design thinking, finance, innovation, start-ups, prototyping, storytelling and much more.

The AVP minor seeks to inspire and provide students with insight and experience needed to build bold new ventures either as new independent startup companies or within existing companies. In AVP you'll learn by doing together with people from various backgrounds and nationalities. This will teach you practical 'street smarts' for starting new ventures, which is one of the best ways to making an impact in real life.

The AVP minor can be completed with two tracks, one focusing on start-up entrepreneurship and one on product and opportunity development. Each track is based on a large project course. The project courses are supported by 1-2 required core courses and a large selection of elective courses (AVP electives).

Although most courses in the minor are cross-school courses and as such broadly accessible for students from different schools within Aalto University, please note that individual courses may have group size limits and separate application procedures.

Students of Industrial Engineering and Management cannot include AVP in their degree as the required technology-related minor, but can include it as a second minor instead of elective studies.

Code	Name	Credits	Period
Startup Track			
Optional introduction			
CS-E5100	Introduction to IT Business and Venturing	2	I-II
Required project course			
TU-E4100	Startup Experience	9	III-IV
Required course			
23E85000	Storytelling - a Narrative Approach for Entrepreneurship	3	
Elective courses as needed	Choose from AVP electives		
Prototype Track			
Required project course			
MEC-E3001	Product Development Project **OR**	10	I-V
ENG-E3102	Global Team-based Design Innovation	10	I-V
Required course			
TU-E4040	Opportunity Prototyping	3	I
	OR		
TU-E4060	Design and Innovation in Context	6	II
Elective courses as needed	Choose from AVP electives		
AVP Electives			

In addition to the courses in Startup Track and Prototype Track, the AVP electives consist of the following courses. To augment the tracks, a student can include as many of these as needed to reach the credits required for the minor.

TU-E4030	Entrepreneurial Finance	5	IV
TU-E4050	Entrepreneurial Leadership	5	III

TU-E4070	Entrepreneurial Marketing	5	IV
TU-E4110	Aalto Fellows	5	V
TU-E4040	Opportunity Prototyping	3	I
TU-E4060	Design and Innovation in Context	6	II
TU-E4080	Managing Innovative Sales	3	II
TU-E4090	Managing Innovative Sales, exercises	3	II
TU-E1020	Strategies for Growth and Renewal	3	III-IV
23E85000	Storytelling - A Narrative Approach for Entrepreneurship	3	
25E18000	Sustainable Entrepreneurship	6	IV
25E50000	Venture Ideation	6	I-II
25E19000	Entrepreneurial Competencies	6	I
25E52000	Market Entry Strategies for Entrepreneurial Business	6	
CS-E2100	Introduction to IT Business and Venturing	2	I-II
CS-E5390	Seminar on Law and Technology, " Exploitation of IPR"	3	IV
Kon-41.4014	Internship Innovation Project	6	III-IV
CS-E5440	Growth and Internationalization of Technology SME's	4	V
TU-E4000	Changemakers	I	I, II, III or IV
TU-E4011	High Growth Entrepreneurship with varying content	1-20	

Analytics and Data Science

Basic information of the minor

Code: SCI3073

Extent:

- 20-25 cr for students of the Aalto schools of technology
- 24 cr for students of the School of Art, Design and Architecture and the School of Business

Language: English

Professors in charge: Associate Professor Aristides Gionis (SCI) & Assistant Professor Pekka Malo (BIZ)

Target group: All Aalto master students who want to sharpen their data analysis skills and be educated on the application of data science methods to different domains.

Application procedure: If you are interested in taking the minor, please contact Study Coordinator Anu Kuusela (anu.kuusela@aalto.fi). The student needs to have confirmed her/his personal study plan (HOPS) before registering for the minor.

Quotas: No quotas for the minor; separate courses may have space for only a limited number of students. If you are not admitted to a course, you will have to choose another course.

Prerequisites: No prerequisites for the minor as a whole, but some courses may have their own prerequisites. The prerequisites can be checked in the course descriptions; if in doubt, please consult the teacher of the course.

Content and structure of the minor

We live in the information age, where a deluge of data is being generated by human activity, scientific data collection processes, business transactions, and adoption of new technologies. Distilling the information contained in such big volumes of data has the potential to transform science, technology, business, and arts, and to revolutionise the organisation and functioning of society. Data science is a new discipline that has emerged and its objective is to provide the students with knowledge of the underlying theory and with the necessary tools to cope with the data revolution. The goal of the Analytics and Data Science minor in Aalto is to educate students on becoming proficient in making sense of such big data, and in applying data analysis skills to their domain of expertise.

The minor is structured in four subareas. Students need to complete courses from different subareas, as indicated in the course description below.

Structure

The module is composed of elective courses in four subareas:

SF: Statistical foundations
CM: Computational methods
BA: Business analytics
AP: Applications

Subarea	Code	Name	Credits	Period
1) COMPULSORY COURSE				
	CS-E4620	Introduction to Analytics and Data Science	2	I
2) AT LEAST ONE COURSE FROM THE SF SUBAREA				
SF	CS-E5710	Bayesian Data Analysis	5	I-II
SF	MS-C2104	Introduction to Statistical Inference	5	III-IV
SF	MS-C2128	Prediction and Time Series Analysis (in Finnish only) *	5	II
SF	30E00800	Time Series Analysis*	6	IV-V
SF	MS-E2112	Multivariate Statistical Analysis	5	III-IV
3) AT LEAST ONE COURSE FROM THE CM SUBAREA				
CM	CS-E3210	Machine Learning: Basic Principles	5	I-II
CM	CS-E4600	Algorithmic Methods of Data Mining	5	I-II
CM	CS-E4840	Information Visualization	5	IV
CM	CS-E4120	Scalable Cloud Computing	5	I-II
CM	CS-E4100	Mobile Cloud Computing	5	I-II
4) SELECT AT LEAST ONE OF THE FOLLOWING				
BA	MS-E2134	Decision Making and Problem Solving	5	I
BA	23E47000	Digital Marketing	6	I, V
BA	30E03000	Data science for Business	6	IV
BA	37E01600	Data Resources Management	6	III
BA	57E00500	Capstone: Business Intelligence	6	I
BA	31E00920	Applied Microeconomics II	6	IV

BA	31E40100	History of Economic Growth and Crisis	6	II
AP	CS-E5740	Complex Networks	5	II
AP	CS-E5730	Mathematical Modeling of Social Dynamics	5	II (2015)
AP	MS-C2103	Design of Experiments and Statistical Models (in Finnish only)	5	III
AP	MS-E2177	Seminar on Case Studies in Operation Research (in Finnish only)	5	III-IV
AP	ELEC-E5510	Speech Recognition	5	II
AP	CS-E4870	Research Project in Machine Learning and Data Science	5-10	I-II
AP/BA	31E00910	Applied Microeconometrics I	6	II
AP/BA	31E00700	Labor Economics	6	V
AP/BA	31E40200	Economics of Science and Innovation	6	III
AP/BA	31E16000	Development Economics II	6	IV

* The courses MS-C2128 and 30E00800 are alternative, i.e. the student can include only one of them in the degree.

Bioinformatics

Code: SCI3064

Extent: 25 credits

Language: English

Teacher in charge: Harri Lähdesmäki

Target group: Students interested in developing and applying computational methods in biological, biomedical and bioeconomy applications. In particular, the minor is designed to complement any major in the Life Science Technologies programme, as well as the major Machine Learning and Data Mining.

Application procedure: The minor is open for all master's students at the Aalto University schools of tehcnology.

Quotas and restrictions: No quotas

Prerequisites: No prerequisites for the minor as a whole, some courses may have their own prerequisites.

Content and structure of the minor

The Bioinformatics minor in the Life Science Technologies programme is designed to provide students with competence in bioinformatics and computational systems biology. The minor equips students with skills and tools to develop new computational methods and models and to apply them to real world biomolecular data. Computer practicals are part of most courses ensuring understanding of both theory and practice of the methods. The biological background knowledge can be broadened with an elective minor.

State-of-the-art methods for analysing next-generation sequencing, microarray and other omics data as well as biological networks are part of the curriculum. Examples of research questions studied include predicting drug-target interactions, reconstructing biological networks, finding associations between genotypes and diseases, and modelling dynamical behaviour of complex biological pathways.

Structure of the minor

Code	Name	Credits
Compulsory courses		10
CS-E5860	Computational Genomics	5
CS-E5870	High-throughput Bioinformatics	5
Elective courses		15
Select as many courses as needed to fulfill the 25-credit requirement		
NBE-E4030	Experimental and Statistical Methods in Biological Sciences	5
CS-E5880	Modelling Biological Networks	5
CS-E5890	Statistical Genetics and Personalised Medicine	5
CS-E4860	Special Course in Bioinformatics II	5
CS-E3210	Machine Learning: Basic Principles	5
CS-E4830	Kernel Methods in Machine Learning	5
CS-E4820	Machine Learning: Advanced Probabilistic Methods	5
CS-E4840	Information Visualization	5

Biomedical Engineering

Code: SCI3065

Extent: 25 credits

Language: English

Teacher in charge: Ari Koskelainen

Target group: Students of the Master's Programme in Life Science Technologies or students of other technology-oriented master's programmes.

Application procedure: Open for all students of Aalto University

Quotas and restrictions: No quotas

Prerequisites: BSc studies in the Bioinformation Technology major or equivalent knowledge in mathematics and physics.

Content and structure of the minor

Biomedical Engineering builds on a solid basis of physics and technology to characterise, monitor, image, and influence biological systems. The minor introduces the student to the physics of biological systems in order to efficiently measure, image, and model such systems.

To complete the minor (25 ECTS credits) the students have to take compulsory minor subject courses towards the minor (10 cr) and elective courses (15 cr) from the course list given below.

Structure of the minor

Code	Name	Credits
Compulsory courses		10
NBE-E4050	Signal Processing in Biomedical Engineering	5
NBE-E4000	Principles of Biomedical Imaging	5
Elective courses		15
Select as many courses as needed to fulfill the 25-credit requirement.		
NBE-E4100	Molecular Biophysics	5
NBE-E4510	Special Assignment in Biomedical Engineering	10
NBE-E4120	Cellular Electrophysiology	5
NBE-E4140	Neurophysics	5
NBE-E4130	Information Processing in Neural Circuits	5
NBE-E4060	Bioelectromagnetism: Fundamentals, Modelling and Application	5
NBE-E4020	Medical Imaging	5
NBE-E4010	Medical Image Analysis	5

Complex Systems

Code: SCI3066

Extent: 25 credits

Language: English

Teacher in charge: Jari Saramäki

Target group: MSc students with sufficient prerequisite knowledge

Application procedure: Open for all students of Aalto University

Quotas and restrictions: No quotas

Prerequisites: Elementary university-level mathematics: calculus, linear algebra, probability and statistics. Programming (knowledge of Matlab and/or Python will help).

Content and structure of the minor

The aim is to introduce the student to the computational and theoretical background that is necessary for a quantitative understanding of complex systems, from the human brain to a diversity of biological and social systems. The skills learned here are helpful for students considering interdisciplinary scientific careers, or, e.g. for industrial data scientist positions.

Structure of the minor

Code	Name	Credits
Compulsory courses		10
NBE-E4030	Experimental and Statistical Methods in Biological Sciences	5
CS-E5740	Complex Networks	5
Elective courses		15
Select as many courses as needed to fulfill the 25-credit requirement		
CS-E4840	Information Visualization	5
CS-E5700	Hands-On Network Analysis	5
CS-E5720	Work Course on Bayesian Analysis	2
CS-E40xx	Special course in Machine Learning and Data Science	5
CS-E3210	Machine Learning: Basic Principles	5

CS-E5730	Mathematical Modelling of Social Dynamics	5
CS-E5750	Nonlinear Dynamics and Chaos	5
CS-L4090	Nonequilibrium Statistical Physics*	7

*The course is not lectured in 2016-2017

Computer Science

Code: SCI3068

Extent: 20-25 credits

Language: English

Teacher in charge: Professor Petri Vuorimaa

Target group: All master's students with sufficient prerequisite knowledge.

Application procedure: Open for all students of Aalto University

Quotas and restrictions: No quotas.

Prerequisites:

Students are requested to check the prerequisites of the courses before signing up.

Content and structure of the minor

The minor provides all Aalto students an opportunity to include computer science as part of their studies. The minor contains a broad selection of courses.

Students select courses from one study track of the major. The tracks are described in more detail in the study guide of Computer Science majors. The minor can contain courses from the core, compulsory, and elective courses lists of the study track. Students are requested to check the prerequisites of the courses before signing up.

Study tracks:

- Software Systems and Technologies
- Secure Systems
- Web Technologies, Applications, and Science
- Interactive Technologies
- Algorithms, Logic, and Computation
- Big Data and Large-Scale Computing

You are welcome to include also courses of other study tracks in the elective studies.

Engineering Physics

Code: SCI3075

Extent: 25 cr

Language: English

Teacher in charge: Mikko Alava

Target group: All master's students with sufficient prerequisite knowledge.

Application procedure: Open for all students of Aalto University

Quotas and restrictions: No quotas.

Prerequisites: Bachelor’s - level minor in Engineering Physics (offered in Finnish) or Advanced Energy Systems (offered in Finnish) or equivalent knowledge.

Content and structure of the minor

The Engineering Physics minor consists of one course out of two research methods courses and 20 credits where the student can modify the minor according to personal interests. In case of prerequisites or a need for more tailored choices, these can be agreed on together with the professor in charge.

Structure of the minor

Code	Name	Credits	Period
Compulsory courses		5	
PHYS-E0411	Advanced Physics Laboratory	5	III-V
OR			
PHYS-E0412	Computational Physics	5	III-V
Elective courses		20	
20 credits seleceted freely from the following courses			
PHYS-E0413	Theoretical Mechanics	5	I-II
PHYS-E0414	Advanced Quantum Mechanics	5	I-II
PHYS-E0415	Statistical Mechanics	5	I-II
PHYS-E0421	Solid-State Physics	5	IV-V
PHYS-E0422	Soft Condensed Matter Physics	5	III-IV
PHYS-E0435	Optical Physics	5	I-II
PHYS-E0460	Reaktorifysiikan perusteet	5	I-II

PHYS-E0463	Fusion Energy Technology	5	III-IV
PHYS-E0483	Advances in New Energy Technologies	5	III-IV

Human Neuroscience and Technology

Code: SCI3067

Extent: 20 credits

Language: English

Teacher in charge: Mikko Sams (in academic year 2016-2017 Iiro Jääskeläinen)

Target group: Anyone interested in understanding the basics of human neurocognitive functions.

Application procedure: Open for all students of Aalto University

Quotas and restrictions: No quotas

Prerequisites: No prerequisites for the minor as a whole, some courses may have their own prerequisites.

Content and structure of the minor

To provide students with the basics of human neurocognitive functions. Such knowledge is useful, e.g. in developing new types of human-computer interfaces and health technology applications.

The minor includes 10 credits of compulsory courses and 10 credits of elective courses. Suitable elective courses can be selected from the list below.

Structure of the minor

Code	Name	Credits
Compulsory courses		10
NBE-E4210	Structure and Functions of the Human Brain	5
NBE-E4220	Introduction to Human Neuroscience	5
Elective courses		10
Select as many courses as needed to fulfill the 25-credit requirement		
NBE-E4000	Principles of Biomedial Imaging	5
NBE-E4040	Functional brain Imaging: Practice	5
NBE-E4500	Special Assignment in Human Neuroscience	5 - 10

NBE-E4240	Advanced Course on Human Neuroscience	5
NBE-E4230	Affective Neuroscience	3
7535099	Social interaction and its biological foundations *	

*The course is lectured in the University of Helsinki

Leadership and Knowledge Management

Code: SCI3078

Extent: 20-25

Language: English

Teacher in charge: Matti Vartiainen, Eila Järvenpää, Esa Saarinen

Target group: All students with sufficient prerequisite knowledge.

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: No quotas.

Prerequisites: TU-C1010 Ihminen ryhmässä (5 op) and TU-C3021 Managing Knowledge and Knowledge-intensive organizations (5 cr)

Content and structure of the minor

The minor in Leadership and Knowledge Management focuses on people in technology-based work, and investigates leadership, collaboration and the human potential as critical success factors for creating and transforming technology-based organisations.
The mission of the minor is to promote the role of people in the success of companies, public organisations and society at large. Its research and teaching concentrates on the fundamental human factors that affect sustainable growth in technology-intensive environments. With particular emphasis on engineering and innovation, the primary interest of the minor is leadership and self-leadership, interaction, knowledge sharing, learning, collaboration, wellbeing and the attitudes of people in the context of work.

The students doing a minor in Leadership and Knowledge Management will learn to lead and inspire people in technology-intensive environments. They will learn skills and knowledge required to

- lead change in an organisational context;
- enhance teamwork and collaboration;
- create and utilise knowledge in emerging forms of organisations.

Students pursuing this minor will learn to understand human behaviour and gain skills and knowledge required to

- analyse and utilise individual and organisational knowledge,
- evaluate and develop organizations and work practices,
- explore human potential and growth and create better collaboration in organisations.

They will learn to envision a better future and understand

- how future organisations evolve,
- how an ethically better future for businesses and society can be built,
- why self-leadership is essential for building better life.

The minor will bring added value to the student's careers. Combining leadership and knowledge management topics with major studies especially in the Aalto University schools of technology helps students to integrate people-related knowledge to their special technical and engineering skills. Therefore, the competences and capabilities learnt in this minor create opportunities for proceeding to a number of areas of expertise and management.

Structure of the minor

Code	Name	Credits	Period
Compulsory courses 10 credits			
TU-E3020	Knowledge Management in Practice	5	I-II
TU-E3010	Leading as Practice	5	III-IV
Elective courses, choose 10-15 credits:			
TU-E3090	Research Assignment in Leadership and Knowledge Management	5	I-II, III-V
TU-E3030	Collaboration in Networks	5	I-II
TU-E3040	Human Potential	5	III-IV
TU-E3110	Work Design in Organizations	5	IV-V
TU-E3150	Safety Management in Complex Sociotechnical Systems	5	IV-V
TU-E4050	Entrepreneurial Leadership	5	III
TU-E3120	Human Resources in Service Operations	5	I-II
TU-E3130	Luovan ongelmanratkaisun seminaari V	5-8	II
TU-E3160	Leadership and Knowledge Management, Special Topics	1-10	I, II, III, IV or V (check course website)

TU-C3021	Managing Knowledge and Knowledge-intensive Organizations (if not included in B.Sc minor)	5	III-IV
TU-A1150	Filosofia ja systeemiajattelu (if this course has been completed for Bachelor's degree, it cannot be included in minor studies)	3	III-IV

Note: The Reseach Assignment in the minor is required for those who are planning to do their master's thesis in Leadership and Knowledge Management.

Courses which fulfil the requirements of Leadership and Knowledge Management minor are offered also by Aalto University Open University:
- TU-E3020 Knowledge Management in Practice may be substituted with Ako-E3020 Knowledge Management in Practice (5 cr)
- TU-E3010 Leading as Practice (5 cr) may be substituted with Ako-E3010 Johtaminen ja johtajuus (5 op)
- The elective courses of the minor may include Ako-E3410 Organisaatioteoria (5 op), Ako-E3420 Organisaation kehittäminen (5 op) and Ako-E3140 Suorituksen ja palkitsemisen johtaminen (5 op).

Open University studies are subject to a fee, and the number of participants on the courses are limited. Further information is available on the Open University website.

Machine Learning and Data Mining

Code: SCI3070

Extent: 20-25 credits

Language: English

Teacher in charge: Professor Samuel Kaski

Target group: All master's students with sufficient prerequisite knowledge.

Application procedure: Open for all students of Aalto University

Quotas and restrictions: No quotas

Prerequisites:

Please check the prerequisites of the courses before signing up.

Content and structure of the minor

Students take the compulsory course T-61.3050 Machine Learning: Basic Principles and select additional courses from the elective courses list.

Structure of the minor

Code	Name	Credits
Compulsory course		5
CS-E3210	Machine Learning: Basic Principles	5
Elective courses		15-20
CS-E5710	Bayesian Data Analysis	5
CS-E4810	Machine Learning and Neural Networks	5
CS-E4820	Machine Learning: Advanced Probabilistic Methods	5
CS-E4600	Algorithmic Methods of Data Mining	5
CS-E4830	Kernel Methods in Machine Learning	5
CS-E4840	Information Visualization	5
CS-E4870	Research Project in Machine Learning and Data Science	5

Mathematics

Code: SCI3076

Extent: 20-25 cr

Language: English

Teacher in charge: Nuutti Hyvönen, Alexander Engström, Gustaf Gripenberg, Antti Hannukainen, Camilla Hollanti, Juha Kinnunen, Pauliina Ilmonen, Kalle Kytölä, Lasse Leskelä, Rolf Stenberg, Riikka Korte

Target group: All master's students with sufficient prerequisite knowledge.

Application procedure: Open for all students of Aalto University

Quotas and restrictions: No quotas.

Prerequisites: Bachelor-level minor in Mathematics or equivalent knowledge.

Content and structure of the minor

Objectives

The minor in *Mathematics* is designed for students interested in mathematical sciences and their application to other disciplines. The minor is motivated by the increase in the importance of mathematical and computational techniques in science and engineering as new fields employing sophisticated mathematical models are constantly emerging.

Mathematics is a flexible minor: The student chooses 20-25 credits of courses in mathematics, mechanics and statistics. It is recommended that the student discusses the choice of courses with one of the professors in charge. The courses, as well as the supervising professor, are to be chosen so that they support the interests and other studies of the student.

Structure of the minor

The student selects 20-25 credits of MS-E courses under the supervision of a professor in charge. A non-exhaustive list of accepted courses is as follows:

Code	Name	Credits	Period
MS-E1000	Crystal Flowers in Halls of Mirrors: Mathematics meets Art and Architecture	5-15	III-IV
MS-E1050	Graph theory	5	I
MS-E1051	Combinatorics	5	II
MS-E1110	Number Theory	5	II
MS-E1111	Galois Theory	5	IV
MS-E1280	Measure and Integral	5	II
MS-E1281	Real Analysis	5	IV
MS-E1460	Functional Analysis	5	I
MS-E1531	Differential Geometry	5	III
MS-E1600	Probability Theory	5	III
MS-E1601	Brownian Motion and Stochastic Analysis	5	II
MS-E1602	Large Random Systems	5	IV
MS-E1651	Numerical Matrix Computations	5	I
MS-E1652	Computational Methods for Differential Equations	5	II
MS-E1653	Finite Element Method	5	III-IV
MS-E1654	Computational Inverse Problems	5	IV
MS-E1740	Continuum Mechanics 1	5	I
MS-E1741	Continuum Mechanics 2	5	II
MS-E1742	Computational Mechanics 1	5	IV
MS-E1743	Computational Mechanics 2	5	V
MS-E2112	Multivariate Statistical Analysis	5	III-IV
MS-E2139	Nonlinear Programming	5	II

Sample combinations of the minor

Analysis 20-25 cr (Prof. Juha Kinnunen)
MS-E1280 Measure and Integral (5 cr), MS-E1281 Real Analysis (5 cr), MS-E1460 Functional Analysis (5 cr), MS-E1531 Differential Geometry (5 cr). In addition, a course of varying content can be included in the minor.

Discrete Mathematics 20-25 cr (Profs. Alexander Engström and Camilla Hollanti)
MS-E1050 Graph Theory (5 cr), MS-E1051 Combinatorics (5 cr), MS-E1110 Number Theory (5 cr), MS-E1111 Galois Theory (5 cr). In addition, a course of varying content can be included in the minor.

Mechanics 25 cr (Prof. Rolf Stenberg)
MS-E1653 Finite Element Method (5 cr), MS-E1740 Continuum Mechanics 1 (5 cr), MS-E1741 Continuum Mechanics 2 (5 cr), MS-E1742 Computational Mechanics 1 (5 cr), MS-E1743 Computational Mechanics 2 (5 cr).

Numerical analysis 25 cr (Profs. Antti Hannukainen and Nuutti Hyvönen)
MS-E1651 Numerical Matrix Computations (5 cr), MS-E1652 Computational Methods for Differential Equations (5 cr), MS-E1653 Finite Element Method (5 cr), MS-E1654 Computational Inverse Problems (5 cr), MS-E2139 Nonlinear Programming (5 cr).

Stochastics and statistics 20-25 cr (Profs. Pauliina Ilmonen, Kalle Kytölä, Lasse Leskelä)
MS-E1600 Probability Theory, MS-E1601 Brownian Motion and Stochastic analysis, MS-E1602 Large Random Systems, MS-E2112 Multivariate Statistical Analysis. In addition, a course of varying content can be included in the minor.

Mobile Computing, Services and Security

Code: SCI3071

Extent: 20-25 credits

Language: English

Teacher in charge: Professor Antti Ylä-Jääski

Target group: All master's students with sufficient prerequisite knowledge.

Application procedure: Open for all students of Aalto University

Quotas and restrictions: No quotas

Prerequisites:

Please check the prerequisites of the courses before signing up.

Content and structure of the minor

Students select 20-25 credits from the following course list. Courses from the elective courses list of the the major Mobile Computing, Service and Security may be included in the minor, provided prior agreement with the professors in charge.

Structure of the minor

Code	Name	Credits
CS-C3170	Web Software Development	5
CS-C3130	Information Security	5
CS-E4005	Methods and Tools for Network Systems	5
CS-E4130	Computer Networks II - Advanced Features	5
CS-E4140	Applications and Services in Internet	5
CS-E4160	Laboratory Works in Networking and Security	5
CS-E4100	Mobile Cloud Computing	5
CS-E4000	Seminar on Computer Science	5

Operations and Service Management

Code: SCI3079

Extent: 20-25

Language: English

Teacher in charge: Kari Tanskanen, Karlos Artto, Jan Holmström, Paul Lillrank, Risto Rajala, Riitta Smeds

Target group: All master's students with sufficient prerequisite knowledge.

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: No quotas.

Prerequisites: TU-C2020 Operaatioiden johtaminen (Operations Management) or equivalent knowledge OR TU-C3010 Projektien suunnittelu ja ohjaus (Project planning and control) or equivalent knowledge.

Content and structure of the minor

Objectives

Operations management covers issues from operations strategy to efficient execution of operations, i.e., from configuring appropriate resources and processes into a production system that best contributes to the organisation’s goals and gives a competitive advantage to managing the production system in order to provide the best match with demand and supply. The minor in

Operations and Service Management builds on the generic principles on operations management and emphasizes the novel ways of encountering the challenges and utilising the opportunities related to creating and transforming technology-based business.
Advanced production systems cross organisational borders and utilise external resource networks effectively in global scale. Business models have developed beyond the conventional manufacturing-focused forms into service systems and project or solution business. As technological, social or organisational innovations emerge, resources and processes in production systems should be vigorously re-configured for improved performance from the customers', network partners' and society's perspective. Sustainability, effectiveness and efficiency are all important elements of performance. Consequently, the minor in Operations and Service Management covers issues on operations strategy, management of operations in inter-organisational systems, as well as the life-cycle management of production systems and their offerings to clients. Industrial service systems, project business framework, and integration of digital technologies into operations are central contextual themes.

The students minoring in Operations and Service Management will gain a thorough understanding of modern operations and service management practices and the underlying theories. They will learn the principles of

- planning and controlling operations in multi-firm context;
- configuring and managing resources and processes in inter-organisational relationships;
- analysing the performance of and the risks related to modern production systems through the relevant life cycle; and
- managing value in production systems according to the requirements of the dynamic business environments.

There are several fields of specialisation in operations management, and students can select courses from the list to meet their personal learning objectives. It is possible to focus on either services or projects, for example. On the other hand, it is also reasonable to select courses without an explicit specialisation within operations and service management. All in all, managing operations means getting the right things done. Broad knowledge in the field is a solid foundation for general management duties and it gives capabilities to run a new venture, as well.

Students intending to take the minor should have a basic understanding of the following areas and their terminology:

- Concepts and models used to measure financial performance of a firm (TU-A1100 Tuotantotalous 1)
- Concepts and theoretical frameworks that describe the design and operation of a production systems from strategy to daily operations (TU-C2020 Operaatioiden johtaminen).
- Concepts of project management and project business (TU-C3010 Projektien suunnittelu ja ohjaus)

The course codes given in parenthesis above refer to courses that perfectly provide the required basic understanding. A satisfactory substitute is TU-D2000 mentioned in the list below.

Structure of the minor

Choose TU-C2020 Operaatioiden johtaminen (Operations Management 5 cr) OR TU-C3010 Projektien suunnittelu ja ohjaus (Project planning and control, 5 cr) if either of these courses (or equivalent courses) is missing from bachelor's degree.

Code	Name	Credits	Period
Choose 15-20 credits from the following list of 11 courses. Although minor students are primarily to take the 3-credit versions of courses, you may choose one 5-credit course. Please also consider any course-specific prerequisites and restrictions concerning the number of participants. Please note that despite the notation '3-5cr', only two versions of a such courses are available: one for 3 cr and another for 5 cr. Typically, the difference between a 3-credit version and a 5-credit version is a larger assignment. An exception to this is TU-E2000, offered as 3 cr and 6 cr versions.			
TU-E2000	Aalto Introduction to Services	3-6	I
TU-E2011	Industrial Service Operations	5	III-IV
TU-E2020	Advanced Operations Management	3-5	II
TU-E2030	Advanced Project-based Management	3-5	I-II
TU-E2040	Management of External Resources	3-5	I
TU-E2110	Innovation in Operations and Service Management	3-5	III-IV
TU-E6110	Management of Networked Business Processes	3-5	I-II
TU-E2130	Operations Management for New Ventures	3-5	III-IV
TU-E2120	Project Business	3-5	III-IV
TU-E2210	Financial Engineering I	3-5	III-IV
TU-E6140	Yrityspeli	3	I, II, III, IV, V (period V in English)

Software and Service Engineering

Code: SCI3069

Extent: 20-25 credits

Language: English

Teacher in charge: Professor Casper Lassenius

Target group: All master's students with sufficient prerequisite knowledge.

Application procedure: Open for all students of Aalto University

Quotas and restrictions: No quotas.

Prerequisites:

Please check the prerequisites of the courses before signing up.

Content and structure of the minor

The minor in Software and Service Engineering provides students with a flexible way of augmenting their major with the basics of software and service engineering. Due to the small number of compulsory courses, students are free to select a set of courses to support their specific interests.

Students select one of the compulsory courses, and additional courses from the recommended elective courses list. Students should check the prerequisites of the courses before signing up.

Structure of the minor

Code	Name	Credits
Compulsory courses		5
CS-C3150	Software Engineering	5
OR		
CS-E4900	User-centred Methods for Product and Service Design	5
Elective courses		15-20
CS-C3180	Software Design and Modelling	5
CS-E4930	Software Processes and Projects	5
CS-E4940	Requirements Engineering	5
CS-E4950	Software Architectures	5
CS-E4960	Software Testing and Quality Assurance	5
CS-E4900	User-Centered Methods for Product Service Design	5
TU-E2000	Aalto Introduction to Services P	5
CS-E5210	Usability Evaluation	5
CS-E5220	User Interface Construction	5

Strategy and Venturing

Code: SCI3080

Extent: 20-25

Language: English

Teacher in charge: Markku Maula, Marina Biniari, Robin Gustafsson, Mikko Jääskeläinen, Ilkka Kauranen, Peter Kelly, Jens Schmidt, Timo Vuori

Target group: All master's students with sufficient prerequisite knowledge.

Application procedure: Open for all students of Aalto University.

Quotas and restrictions: No quotas.

Prerequisites: TU-C2010 Introduction to Strategic Management (5 cr) or equivalent knowledge.

Content and structure of the minor

The minor in Strategy and Venturing in the IEM program helps student develop capabilities in strategic management and new business development to enable them lead and transform existing business and build new business.

The primary learning outcomes of the Strategy and Venturing minor are to:

- Develop capabilities to lead and organise strategy work to improve value creation
- Develop capabilities to analyse sources of competitive advantage in technology-based business
- Develop capabilities to build and renew technology-based business in new and established organisations

In addition to these primary learning outcomes, studying Strategy and Venturing in the IEM program gives our graduates significant strengths including an integrative understanding of technology and business, a combination of theoretical understanding and a pragmatic can-do attitude, analytical capabilities to solve complex real life problems using data, people skills to build and lead organizations, diverse knowledge and experience from startups to the largest corporations, and a global orientation and ambition level.
The capabilities developed in the minor in Strategy and Venturing are valuable for many career options including strategy and business development functions in corporations, management consulting, investment banking, founders/CEOs in startups, positions in venture capital and private equity firms or other organisations building and transforming technology-based business.

Structure of the minor

Code	Name	Credits	Period
Compulsory courses, 16 credits:			
TU-E1120	Strategic Management of Technology and Innovation	5	III-V
TU-E1020	Strategies for Growth and Renewal	3	III-IV
TU-E4030	Entrepreneurial Finance	5	IV
TU-E4040	Opportunity Prototyping	3	I
Elective courses, choose from the list below:			
TU-E4080	Managing Innovative Sales	3	II
TU-E4090	Managing Innovative Sales, exercises	3	II
TU-E1150	Managerial Economics	5	III
TU-E1160	International Economics	5	IV

Systems and Operations Research

Code: SCI3077

Extent: 20-25 cr

Language: English

Teacher in charge: Harri Ehtamo, Enrico Bartolini, Ahti Salo, Kai Virtanen

Target group: All master's students with sufficient prerequisite knowledge

Application procedure: Open for all students of Aalto University

Quotas and restrictions: No quotas.

Prerequisites: Bachelor-level minor in Systems Sciences or equivalent knowledge.

Content and structure of the minor

Objectives

The goal of the minor in *Systems and Operations Research* is to teach students modelling methods and practical skills for problem solving and decision making in complex industrial, managerial, economic and environmental problems. Systems analysis and operations research are needed everywhere in the modern society. Modelling and decision support are essential in energy markets and environmental management as well as in understanding the complex dynamics of climate change. The graduates in Systems and Operations Research are in high demand in many areas ranging from the financial sector to industry, energy and the environment.

Structure of the minor

The topics of the minor include optimisation, simulation, dynamic systems, decision modelling, statistics, forecasting and risk analysis.

Code	Name	Credits	Period
Core courses (mandatory):		10	
MS-E2134	Decision making and problem solving	5	I
MS-E2139	Nonlinear programming	5	II
OR			
MS-E2140	Linear programming	5	I
Select 10-15 credits of elective courses:			
TU-A1150	Filosofia ja systeemiajattelu	3	III-IV
MS-E2112	Multivariate Statistical Analysis	5	III-IV
MS-E2114	Investment Science	5	IV
MS-E2117	Riskianalyysi	5	III-IV
MS-E2129	Systeemien identifiointi	5	I-II

MS-E2130	Matemaattinen malliajattelu	3-6	I-II
MS-E2133	Systems Analysis Laboratory II	5	I-II
MS-E2136	Special Topics in Decision Making	3-6	
MS-E2139	Nonlinear Programming	5	II
MS-E2140	Linear Programming	5	I
MS-E2142	Optimointiopin seminaari	5	
MS-E2146	Integer Programming	5	IV
MS-E2148	Dynamic Optimization	5	III
MS-E2152	Peliteoria	5	I-II
MS-E2170	Simulation	5	IV
MS-E2177	Operaatiotutkimuksen projektityöseminaari	5	III-IV
MS-E2195	Web-based Courses in Systems Analysis	1-6	I-II, III-V
TU-E3130	Luovan ongelmanratkaisun seminaari	5-8	I-II

SCI minors only for students of SCI

SCI minors only for students of SCI

In the guide, the SCI minors have been classified under two headings: SCI minors for all Aalto students and SCI minors only for SCI students.

On the page **SCI minors for all Aalto students** you can find information about those SCI minors which are primarily open for all Aalto University students. Please note that some of such minors may, however, be offered only to students of certain majors/departments.

Under **SCI minors only for SCI students**, you can find information about those minors which are intended only for students of SCI.

The more specific target groups of each minor are explained in the descriptions of the minors. The descriptions also provide information on the application procedure and any restrictions regarding applicants.

SCI minors only for students of SCI

Minor	Extent (ECTS)	Language of instruction
Individual Minor Subject	20-25	According to agreement
International Studies Minor	20-25	According to agreement
Minor completed at a Finnish University	20-25	According to agreement

Minor completed at a University Abroad	20-25	According to agreement

Individual Minor Subject

Basic information of the minor

Code: SCI3040

Extent: 20-25 cr

Language: According to agreement

Professor in charge:

- Bachelor’s degree: Professors in charge of the majors
- Master’s degree: Directors of the degree programmes

Target group: Students of the School of Science

Quotas and restrictions: Only for students studying in the new degree structure.

Name of the minor in other languages: Henkilökohtainen sivuaine, Personligt biämne

Content and structure of the minor

Individual Minor Subject is targeted mainly for students who change their study right from the old degree structure (2005 degree regulations) to the new degree structure (2013 degree regulations) and who have already completed courses from a minor which is not offered anymore in the new degree structure.

Individual Minor Subject can be accepted in student’s personal study plan only with good grounds. The courses included in the minor need to create a clear entity, which can be easily named. In the Bachelor’s degree, the professor in charge of the major accepts the minor. In Master’s degree, the director of the programme accepts the minor.

Usually the minor is chosen among minors confirmed in Aalto University, done abroad during student exchange or done in another Finnish university.

International Studies Minor

Basic information of the minor

Code: SCI3041

Extent: 20-25 cr

Language: According to agreement

Professor in charge:

- Bachelor's degree: Professors in charge of the majors
- Master's degree: Directors of the degree programmes

Target group: Students of the School of Science

Quotas and restrictions: Only for students studying in the new degree structure.

Content and structure of the minor

International studies minor consists of courses, which are relevant to student's degree at Aalto University and which are completed during the student exchange abroad. International study minor is a strong and visible unit of international dimension in a student's degree and addresses the need for engineers who can combine technical expertise with international understanding.

In addition to the professional content of the minor, module aims to produce knowledge and practical skills in languages and intercultural competence as well as for the needs of modern working life, learned after direct experience of studying and practicing of engineering in a foreign country. Skills such as critical thinking, ability to use relevant theoretical concepts according to context and ability to cope with uncertainty and multiple interpretations. Furthermore, student will possess an increased knowledge base related to the country or region where the student gains his/her global experience.

International studies minor consists of 20-25 credits and it can be a minor either in Bachelor of Science or Master of Science degree in the new degree structure. It may include other than the student's major subject studies, as well as the host country language and cultural studies and it can be interdisciplinary by its nature. International minor content should be discussed in advance with the planning officer and the professor of student's major. It is possible to supplement the International Studies Minor with courses completed at Aalto University with maximum of 5 credits. Supplementation should be agreed beforehand with the planning officer and the professor of student's major. International studies minor is graded with the scale of pass/fail. Terms and conditions of Aalto University student exchange applies.

Students of Industrial Engineering and Management and Information Networks: International studies minor is possible as elective studies as the minor of the degree has to be technical. *Note that in Information Networks this concerns only Bachelor's degree.*

Minimum requirement to gain the International Studies minor status:

- Credits: 20-25 cr
- Minimum requirement for professional studies completed during the exchange: 15 credits
- Maximum requirement for language and cultural studies (with the exception of specific Language and Culture Study unities offered by exchange partner universities): 10 credits
- Maximum supplementation with Aalto University courses: 5 credits. Following courses are recommended: language courses (advanced level), international communication courses, internationally oriented professional courses taught in English.
- Traineeship abroad can be considered a way of completing the module (max 5 credits)
- Cannot include Master's Thesis

Minor completed at a Finnish University

Code: M1FINU-SCI

Extent: 20-25

Language: As agreed

Teacher in charge: Bachelor's level: Professors in charge of the majors; Master's level: Director's of the degree programmes.
Target group: Students of School of Science

Quotas and restrictions: Only for students pursuing studies in accordance with the new degree structure.

Content and structure of the minor

The Minor Completed at a Finnish University is intended for students who complete an entire minor at another Finnish university, primarily as JOO studies (flexible study right). The minor studied must be a fixed module offered or otherwise approved by the university (e.g. the basic studies module of a given subject). If the extent of the minor does not meet the minimum requirement, the student may complement the minor with other relevant Aalto University courses.

The minor of students majoring in Industrial Engineering and Management or Information Networks has to be in a field of technology, i.e. the content and learning objectives must be consistent with the specific regulations stated in the curricula. *Note that in Information Networks this concerns only Bachelor's degree.*

Minor completed at a University Abroad

Code: M1ABR-SCI

Language: As agreed

Teacher in charge: Bachelor's degree: Professors in charge of majors; Master of Science (Technology): The degree programme directors

Target group: Students of the School of Science

Quotas and restrictions: Only for students pursuing studies in accordance with the new degree structure.

Content and structure of the minor

The Minor Completed at a University Abroad is intended for students who complete a minor entirely abroad, usually during a student exchange. The minor may be a standard module of studies offered by the foreign university or a collection of studies taken within a certain subject. The minor may not be just a compilation of courses, but a clearly defined package that is coherent, verifiable and compiled from the course offerings of the target university. If the extent of the foreign university minor does not meet Aalto's minimum requirements, the student may supplement it with suitable courses from Aalto.

The completion of the minor abroad must be agreed in advance and included in the learning agreement made for the student exchange. In addition, the student must provide a link to the university's webpages where the module or courses taken can be verified.

The minor module for students majoring in Industrial Engineering and Management or Information Networks must correspond to the conditions described in the Aalto curriculum in terms of content and learning outcomes; that is, it must meet the technical requirements. In these cases, the courses chosen for inclusion in the minor are to be from a technical subject. *Please note: For Information Networks students, this applies only to bachelor's degree minors.*

SCI individual courses for all Aalto students

SCI individual courses for all Aalto students

Degree students at other Aalto Schools do not need to separately apply for a study right in order to complete courses at the School of Science.

From the pool of enrolled students, participants for the course are chosen according to a prioritizing order defined for the course. If there is such a prioritizing order defined for the course, it is explained in the course description. Before enrolling for the course, check the preliminary requirements at weboodi: https://oodi.aalto.fi/a/frame.jsp?Kieli=6&valittuKieli=6.

You can find the School of Science course listing at weboodi https://oodi.aalto.fi/a/frame.jsp?Kieli=6&valittuKieli=6.

Contact information

School of Science

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