

Study guide 2013-2014

**School of
Engineering:**

**Master's Degree
Programmes**

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GENERAL INFORMATION

For student

Welcome to the School of Engineering!

This Study Guide contains information about the Master's Degree Programmes and the study practices and academic issues at the Aalto University School of Engineering. You can find further information in the following electronic systems:

- **WebOodi** (<https://oodi.aalto.fi>). It includes information and descriptions of courses, registering for courses, examinations and teaching, as well as checking completed credits and ordering transcripts of records.
- **Noppa** (<https://noppa.aalto.fi>). It is a web portal for everyday course work and communication. You can find course home pages, course schedules, course results, lecture materials and course news in the portal. Noppa, WebOodi and this Study Guide complete each other and are useful tools in planning your studies.
- **Into** (<https://into.aalto.fi>). This portal is designed for Aalto University students for information and instructions relating to studies, Aalto services and the University. From Into-portal you can find, for instance, the calendar of the academic year, graduation schedule, degree programme news and events at Aalto. The main page for School of Engineering you can find from the address: <https://into.aalto.fi/display/en-mastereng/Homepage>

Academic year 2013 – 2014

Enrolment for academic year

Degree students must register at the Aalto University every academic year either as present or as absent (Act 715/2004, 18c§). Only students who register their presence have a right to study. It is very important that students enroll present or absent during the enrolment period and keep their contact information up to date to receive important information from the University.

Please see the instructions for enrolment: <https://into.aalto.fi/display/enmastereng/Enrolment+for+Academic+Year+2013+-+2014>

Students who have not enrolled will forfeit their right to study. Student who have forfeited their rights to study due to the failure to enroll may apply for readmission.

Teaching and evaluation periods for the academic year 2013-2014

The academic year begins 1 August and ends 31 July (the autumn term 1.8. – 31.12. and the spring term 1.1. – 31.7.) The academic year is divided into five teaching periods, during which courses are given. Additionally, teaching periods may include evaluation sessions related to courses. In addition to the teaching periods, the academic year includes evaluation periods. These evaluation periods can also be used to organize intensive teaching.

Autumn term 2013	
Evaluation period/Teaching period	26.8. – 31.8.2013
Orientation week for new students	2.9. – 7.9.2013
I Teaching period	9.9. – 26.10.2013
II Teaching period	28.10. – 14.12.2013
Evaluation period/Teaching period	16.12. – 21.12.2013
Spring term 2014	
III Teaching period	7.1. – 22.2.2014
IV Teaching period	24.2. – 12.4.2014
V Teaching period	14.4. – 31.5.2014
Evaluation period	2.6. – 7.6.2014

Saturday examination dates

Autumn term 2013: 7.9., 19.10., 26.10., 16.11., 30.11., 7.12., 14.12., 21.12.

Spring term 2014: 11.1., 18.1., 1.2., 22.2., 1.3., 8.3., 12.4., 26.4., 17.5., 24.5.

Aalto University

Aalto University is a multidisciplinary science and art community in the fields of science, economics, and art and design. The University is founded on Finnish strengths, and its goal is to develop as a unique entity to become one of the world's top universities. Aalto University's cornerstones are its strengths in education and research. Aalto University comprises of six Schools: School of Arts, Design and Architecture, The School of Business, The School of Chemical Technology, the School of Electrical Engineering, the School of Engineering and the School of Science. There are approximately 20,000 basic degree and graduate students as well as a staff of 5,000 of whom approximately 350 are professors. The amount of international students are 2,600. The first president of Aalto University is Professor Tuula Teeri (Ph.D.).

Students are important part of the Aalto community. Aalto University is focused on its student-centred culture where critical thinking and open mind are essential. The content of teaching is developed and implemented hand in hand with research. Students at Aalto University can earn a bachelor's degree in economics, art or technology and a master's degree in architecture, in landscape architecture, in arts, in technology and in economics and business administration. These degrees provides also a career for scientific and artistic doctoral studies.

Internationalisation is an important area in university's strategy. Almost 3,000 international students study at Aalto University from approximately 100 nationalities. There are approximately 70 English-language degree programmes. The main objectives are the mobility of students and staff, student recruitment and the development of an international campus area.

Aalto University is benefiting from its multidisciplinary character by launching research projects, study programmes and courses that combine the expertise of technology, economics and art and design. The Schools of Aalto University jointly provide Aalto studies that are open to everyone studying at the University. Aalto studies include individual courses and broader study programmes. Design Factory, Media Factory and Service Factory are platforms for studying, teaching, research and collaboration where academic teams and projects can work together with enterprises and the public sector.

Further information about Aalto University: www.aalto.fi/en/

School of Engineering

There are four technical- focused Schools at Aalto University, and the School of Engineering is one of those. The school has six departments: Applied Mechanics, Civil and Environmental Engineering, Civil and Structural Engineering, Energy Technology, Engineering Design and Production and Real Estate, Planning and Geoinformatics. Also, Center for Energy Technology (CET) and Institute of Building Services Technology belong to the School of Engineering.

The School of Engineering provides top class teaching and educates experts valued by society and able to work for various industries. The school creates new information based on research and experimental activities, as well as solutions that serve the objectives of sustainable development. A strong practical approach and jointly funded research projects are characteristic of the school. The school works in close cooperation with industries and surrounding society.

The School of Engineering offers Bachelor's, Master's and Doctoral degrees. Bachelor's studies are held only in Finnish. Master's level studies are held mainly in Finnish but also some of them have lectures in English. The Finnish degree programmes in master's level are

- Energy and HVAC Technology
- Geomatics
- Real Estate Economics
- Mechanical Engineering
- Structural Engineering and Building Technology
- Civil and Environmental Engineering

The graduates work in esteemed positions as experts and directors in the fields of science and technology. Employment opportunities are good and graduates' knowledge is highly respected throughout enterprises and public sector.

Master's Degree Programmes

The School of Engineering provides also Master's Degree Programmes in English. The programmes are

- Master's Programme in Creative Sustainability
- Master's Programme in Environmental Pathways for Sustainable Energy Engineering
- Master's Programme in Geoinformatics
- Master's Programme in Managing Spatial Change
- Master's Programme in Mechanical Engineering
- Master's Programme in Minerals and Environmental Engineering
- Master's Programme in Real Estate Investment and Finance
- Master's Programme in Structural Engineering.

In addition there are three Nordic Master's Programmes

- Environmental Engineering
- Maritime Engineering
- Innovative and Sustainable Energy Engineering

These programmes are organized by the consortium of Nordic 5TechUniversities (Chalmers, DTU, Aalto, KTH, NTNU). More information about this consortium: <http://www.nordicfivetechnologies.org/>

Last spring the number of selected students for above mentioned Master's Programmes was 126 students.

Master's Programmes are elaborated further in this Study Guide (chapter Master's Programmes).

Organisation and Contact Information

The School of Engineering is headed by a Dean and an Academic Committee. The dean directs the operations of the school and is the head of the academic committee. In addition, the dean's responsibilities are, e.g.

- to appoint and dismiss the heads and deputy head of the school's departments and appoint the head of the doctoral programme and those of the degree programmes.
- to admit students to the school, make the decisions relating to the maximum duration of study, award degrees etc.

From this academic year the School of Engineering has a new dean, Professor *Gary Marquis*, who has started 1st of July, 2013. The vice-deans are Professor Kirsi Virrantaus and Professor Olli Varis.

The Academic Committee for Engineering consists of representatives of tenured professors, other teaching and research staff, and representatives of other staff and students. It deals with the far-reaching academic affairs of the school, such as strategy and the operation plan. In addition, the academic committee have a decision-making power in the curriculum and degree requirements as well as admission criteria.

Other administrative organs which have decision-making power, are the Doctoral Programme Committee, the Degree Programme Committee and the Head of Department. The departments are directed by heads of department, each with a designated deputy.

Further information: <https://inside.aalto.fi/display/eneng/Organisation+and+Decision-Making>

TABLE 1. The numbers of students and degrees

	2011	2012
Master's Degrees	229	324
Doctoral Degrees	14	20
Students	3000	3444
Doctoral students	300	615

Contact Information	
Dean	Gary Marquis, professor tel. +358 40 7201093 gary.marquis@aalto.fi Visiting address: K1 Building, Otakaari 4, Espoo Postal address: P.O Box 14100, 00076 Aalto, Finland
Vice Deans	Kirsi Virrantaus, professor (teaching) tel. +358 50 0463729 kirsi.virrantaus@aalto.fi Visiting address: Genti Building, Vaisalantie 8, Espoo Postal address: P.O Box 15600, 00076 Aalto, Finland Olli Varis, professor (research) tel. +358 50 5661043 olli.varis@aalto.fi Visiting address: Rakentajanaukio 4 A, Espoo Postal address: P.O Box 12100, 00076 Aalto, Finland
Head of Student Affairs	Marjo Immonen tel. +358 50 5839836 marjo.immonen@aalto.fi Visiting address: Rakentajanaukio 4A, Espoo, room R260 Postal address: P.O Box 12100, 00076 Aalto, Finland
Head of International Services	Saara Sokolnicki tel. +358 50 5934886 saara.sokolnicki@aalto.fi Visiting address: K1 Building, Otakaari 4, Espoo Postal address: P.O Box 14100, 00076 Aalto, Finland

International Student Services

- Study counselling
- Individual Study Plan (HOPS in Finnish)
- Graduation etc.

International Student Mobility planning officer and Master's programmes	Börje Helenius, tel. +358 50 5906388, borje.helenius@aalto.fi
Outgoing exchange students planning officer	Mirka Jalonen, tel. +358 50 4090745, mirka.jalonen@aalto.fi
Incoming exchange students student affairs secretary	Hannele Pietola, tel. +358 50 406 6951, hannele.pietola@aalto.fi
Visiting address	K1 Building, Otakaari 4, Espoo

Student Services/ The OOP Service Desk

- Annual enrolment
- Rights to study
- Changes of name and address
- Student attendance certificates

Visiting address	K1 Building, Otakaari 4, Espoo (open Mon – Fri 9-11 and 12-14)
Postal address	P.O Box 14100, 00076 Aalto, Finland
Tel.	+358 50 347 8230
E-mail address	studies-eng@aalto.fi

See also

- eng.aalto.fi
- into.aalto.fi/display/enmastereng/

Academic Issues

Courses

Courses are allocated credits on the basis of the requisite workload. The average input of 1 600 working hours needed for studies of one academic year corresponds to 60 credits. The amount of credits given for the course must be a whole number.

Students have to register for the courses. This can be done online using WebOodi (<https://oodi.aalto.fi>). Registration for courses begins 60 days before the course begins. Since the practice may vary depending on the course, it is necessary to search information on the course registration in advance from Noppa (<https://noppa.aalto.fi>)

1 credit is 27 hours

Examinations

If the degree requirements of a course involve a written or oral examination, a minimum of two possibilities must be arranged for taking the examination each year. To that end, the university organises evaluation periods, which are confirmed annually when confirming the teaching and evaluation periods. Also the times of the Saturday examinations are confirmed at the same time. Additional opportunities for taking examinations may be provided at the discretion of the teacher. Examinations of extensive courses may consist of two or more parts. As regards courses with a large number of students, it is recommended that examinations are held four times a year.

Examinations are organised according to the valid degree requirements specified at the beginning of the course. Examinations for courses to be removed from the curriculum shall be organised at least in the academic year following the removal. If the student wishes to take an examination for a 3 course for which the degree requirements are no longer valid at the time of the examination, the student shall agree on the examination with the teacher.

Obligatory registration

Students shall register for an examination no later than one week before the examination is organised. The list of students registered for the examination is checked before the start of the examination, and only the registered students are let in the examination hall.

Study register

All completed courses are registered in the student register of Aalto University. The office of the degree programme responsible for the course takes care of registration.

Teachers are responsible for checking the examinations within one month from the exam date and of submitting the results to the Degree Programme Office as soon as possible. The Degree Programme Office is responsible for taking the course grades to the student register as soon as they are available. The final grade of the course is registered in the student register only when the course is completed.

Students can order an unofficial transcript of records through WebOodi: <https://oodi.aalto.fi/a/> provided that the student's e-mail address is correctly entered in the student register.

Completed courses , Academic Appeals and the Student's Right for Information

According to the University Act (558/2009) 44 §, the student is entitled to know the evaluation criteria applied to passing a course. The student shall be guaranteed the opportunity to examine the written or otherwise stored grading of the course. The mentioned written or otherwise preserved material has to be stored for at least six months from the publishing of the grades. Courses are evaluated on the basis of one of the two grading scales: A scale of fail/1/2/3/4/5, where 5 is the highest grade, or the grade pass/fail.

A student dissatisfied with the grading of a study attainment or a thesis or with the decision concerning recognition of prior studies or transfer of credits may apply for a rectification of the decision. Guidelines for academic appeals can be found from Aalto University Degree Committees page in Aalto Inside: <https://inside.aalto.fi/display/aallosta/Academic+appeals>

Evaluation and Grading

The methods used for evaluating learning are the following (e.g.):

Examination

The most common evaluation method is a written examination. In addition to the traditional written examination, other exams, such as a pre-exam, an oral exam, a web exam, a material-based exam and a multiple-choice exam may be used. On some courses, the testing may consist of two or more examinations.

Other Evaluation Methods

The teaching methods, such as portfolio, learning diary, demonstration, exercises, written tasks and project assignments can also be used to partially evaluate the course.

Grading

Grading is based on evaluation. The teacher in charge of the course shall evaluate the student's work. According to the degree regulations, the teacher is obliged to publish the list of grades students within one month of the date of the examination. An extension to this timetable may be granted only in special circumstances. Examination results are mainly published in Noppa-portal, sometimes on the notice board.

In the higher university degrees, including the Master's thesis, the grades used are excellent (5), very good (4), good (3), very satisfactory (2) and satisfactory (1). Courses can also be assessed as pass/fail. The maturity test included in the theses is assessed as pass/fail.

Recommendation and Limitation to the Duration of Studies

The Finnish University Act (558/2009) includes recommendations and limitations to the duration of studies. The duration of studies is counted from the date the student accepts the study place in the university. The recommended time to complete a Master of Science degree is two years of full-time studying.

The student has a right to complete his/her degree in two years after the recommended time. If the student has not completed his/her degree in that time, he/she can apply for extension from the school. The extension period should be applied for in the beginning

of the student's last academic year before the study right expires. The extension period will be decided by a Dean.

Further information about the duration of studies is available at <https://into.aalto.fi/display/enmastereng/Aalto+University+policy+on+extension+to+duration+of+studies>

Credit Transfer

By decision of the school the student may transfer credits awarded by other Finnish or foreign universities or institutions as well as compensate for requisite studies with other studies of the same level. Transferring credits on the basis of demonstrating requisite knowledge by other means is also possible. Credits for a thesis may not be transferred. Transfer of credits is applied for by filing a written application.

The transfer of credits for a course or a Study module is marked into the student data register so that the place of earning the original credits is visible. The original grades given for the transferred credits are transformed to comply with the grading scale used in the degree programme of the student, if correspondence can be clearly demonstrated. In other cases, the transferred credits are assigned the grade of 'pass'.

Feedback

Feedback usually refers to the information students or teachers receive on their performance. Feedback provides information about the performance outcome and it can be used in evaluating whether the set goals have been met. Feedback can be used as a tool for developing both the students' and teachers' activities. Learning to give and to receive feedback is part of studying.

Student feedback is used as a tool to develop teaching and course content. It is important to give constructive feedback in order to assist the teachers to discover targets for development and assess how the course has been perceived by the students.

Course Feedback

Feedback can be collected before the course, during the course and after the course, in oral or written format. Feedback forms are opened in WebOodi just before the teaching period ends and they are closed after the examination period. Feedback is also collected from all the graduates.

Information systems

WebOodi (<https://oodi.aalto.fi>)

The registration system for examinations and courses is called WebOodi. In addition, the students can use WebOodi for:

- browsing the study programme information
- planning studies
- ordering course handouts
- checking and ordering their unofficial study transcript
- checking and changing their contact information

Noppa-portal (<https://noppa.aalto.fi>)

The study portal Noppa is a tool for students for communication and managing course work. Noppa consists of course home pages on which the teacher can publish course overviews, schedules of lectures and exercises, course materials, information about assignments and exams, news and exam results. In other words, all important basic information about the courses is collected to one place.

By logging into Noppa the students can have their own personal start page, 'My Noppa', on which they can see the news and important deadlines and exam results of all the courses they have registered.

Into (<https://into.aalto.fi>)

Into is a portal for Aalto University students for information and instructions relating to studies, Aalto services and the news of the University. In Into you can find, for instance, the calendar of the academic year, graduation schedule, degree programme news and events at Aalto University. Services (e.g. Library, IT Services, CareerWeb) also have their own site. You can start browsing Into by selecting your School under the title Bachelor and Master's Students or Doctoral Candidates.

In addition, there are also some **interactive tools** for studying:

- Optima/Moodle (<http://optima.aalto.fi> or <http://moodle.aalto.fi>)
- StudentWiki (<http://studentwiki.aalto.fi>)
- Blogs (<http://blogs.aalto.fi>)
- Connect Pro (<http://connectpro.aalto.fi>)

Libraries

The Aalto University Library operates at three campus areas:

- Arabia Campus Library (design and arts)
- Otaniemi Campus Library (technology)
- Töölö Campus Library (business).

There are also additional department libraries in Otaniemi Campus.

Campus Libraries are open for all customers, and the basic services such as borrowing and information services are for anyone to use. Some of the services are only for students, staff or individual schools of Aalto University. For the most part e-resources are acquired for the use of the whole Aalto University.

Campus Libraries provide services on the spot and via the web.

Further information about services, opening hours, collection databases, electronical materials, research databases etc are available at: <http://lib.aalto.fi/en/>.

Academic Rules and Regulations

The Aalto University has adjudicated regulations, decisions and instructions concerning studying and completing studies and degrees. They are put in place in order to ensure the equal and just treatment and protection of rights for all members of the academic community.

All these rules and regulations can be found as concerted from Into-website: <https://into.aalto.fi/display/enmastereng/Academic+rules+and+regulations>

Tutoring and Study Counselling

Planning your studies is an important part of your university career. Each student has a study path that begins at the beginning of the student's studies and ends when he or she graduates. The aim is to make the study path as rational as possible while ensuring that the studies progress in a planned manner. To help students plan their studies, the School offers them various example schedules and suggestions for the order in which courses should be completed. There are also various guides and study counseling available.

Tutoring

Each student studying for a higher university degree has a nominated teacher tutor who is either an academic coordinator of the programme or professor on the major. The purpose of tutoring is to guide the student during his or her studies. Each student has a personal tutor meeting once per academic year. The purpose of the personal meeting is to review the student's progress and discuss his or her studies regarding student's study plan. The tutor and the student evaluate the student's possibilities to complete his or her studies within the set target time frame.

Personal Study Plan

At the School of Engineering, there are two kinds of study plans in use: unofficial personal study plans (omaHOPS) and official, confirmable module level personal study plans (HOPS).

In the confirmed personal study plan (sometimes referred to as VOPS), choices are made on the module level. This means that the student selects the modules that he or she is going to complete and marks them in a form which is then signed by the student and a representative of the study administration. In both the Bachelor of Science (Technology) degree and the Master of Science (Technology), the major subject of students is confirmed in the confirmed personal study plan. The confirmed personal study plan may contain attached entities that the student has had approved separately.

The study plan is a binding agreement on both parties: the student and the School of Engineering. It grants the student with a right to study according to the confirmed personal study plan but, at the same time, obliges the student to follow his or her study plan.

A student can have only one confirmed personal study plan at a time. If a student wishes to make changes to his or her confirmed study plan, the plan must be reconfirmed after the changes have been made.

The study plan forms are returned to the Planning Officer or the office of the department. The form can be found from [Into-portal:https://into.aalto.fi/display/enmastereng/Forms+for+Bachelor+and+Master+level+studies](https://into.aalto.fi/display/enmastereng/Forms+for+Bachelor+and+Master+level+studies)

Unofficial Study Plan

The students can also prepare an unofficial, detailed course-level study plan including a schedule. The purpose of this unofficial plan is to familiarize students with the degree structure and to clarify the student's personal goals. Using the unofficial study plan the student can monitor the credit accumulation and ensure that the degree requirements are met.

The unofficial OmaHOPS plan can be made using the OodiHOPS tool in WebOodi. It is also possible to create the OmaHOPS plan in other ways.

Master's Thesis and Graduation

The Master's thesis shall be written on a topic related to one's major and the topic shall be agreed upon together with the student and the teacher whose field of speciality includes the topic. The Degree Programme Committee confirms the topic and the language of the thesis as well as appoints the supervisor and the thesis advisor for the thesis. The supervisor can also act as the thesis advisor. The supervisor must be a professor of Aalto University School of Engineering or a docent with full-time employment at the School of Engineering.

The topic of the Master's thesis can be applied for when at least 45 credits of the Master's degree have been completed. The topic is valid for one year from the date it has been confirmed. If the thesis is not submitted for evaluation within that time, the topic expires and must be applied for again.

The Master's thesis work also includes a maturity test and a seminar presentation or an equivalent presentation.

The Master's Thesis is approved and graded by the Degree Programme Committee on the grounds of the written statement given by the supervisor. Approval and grading of the Master's thesis shall be applied for in writing. The Master's Thesis is a public document and as such, shall be displayed in the school library.

More detailed information about the procedure: <https://into.aalto.fi/display/enmastereng/Graduation>

Maturity Essay

The student is required to write a maturity essay related to the topic of the Master's thesis. The maturity essay demonstrates mastery of the thesis subject and language skills (Finnish or Swedish). If the student has been educated in other language than Finnish or Swedish or has been educated abroad, he/she does not have to demonstrate language skills in Finnish or Swedish, only mastery of the thesis subject.

Graduation and Certificates

When the student has completed all the studies required for the higher university degree he/she can apply for graduation. It must be applied for in writing. The degrees for Master of Science (Technology) are approved by the Dean of Aalto University School of Engineering.

If the student has shown excellent knowledge in his or her studies, and shown particular maturity and judgement in the Master's thesis, the certificate for the Master of Science in Technology may be awarded with distinction. A degree with distinction may be awarded if the weighted average grade for courses for the degree, not including the Master's thesis, is at least 4.0 and the grade for the Master's thesis is at least 4. If a course is graded pass/fail, it is not counted in the calculation of the average grade. If some of the student's courses have been completed at another university, a degree with distinction should not generally be awarded, unless at least half of the degree studies, not including the Master's thesis, are completed at this university.

The Dean of Aalto University School of Engineering awards the degree certificates in ceremonies which are arranged approximately twice per semester. The dates of the graduation ceremonies can be found at <https://into.aalto.fi/display/enmastereng/Graduation+ceremonies>

Students who are unable to attend the ceremony can receive their diplomas from the Student Services, address Otakaari 4, during the opening hours.

Studies at Schools of Aalto University and in other universities

Aalto University provides cross-disciplinary studies and opportunities for degree students to study at different schools of Aalto University. Within the field of technology mobility is more free and students do not need to apply through internal mobility.

There are also so called Aalto courses which are organized by one or more Aalto schools. These courses are open to all students at the university, regardless of their field of study.

Application period for internal mobility studies is four times a year.

Flexible study right JOO

The Flexible Study Rights Agreement (JOO) provides graduate and post-graduate students of Finnish universities the opportunity to include courses from other universities into their degrees. JOO agreement allows a student to apply for a temporary study right at another Finnish University.

Aalto University uses with some exceptions two application periods for JOO-studies. During the main application period in April, students can apply for the JOO-courses that are held during the next academic year. In October it is possible to apply for the courses that are held next spring.

The application process

The application for JOO studies is done in the electronic Joopas application system (www.joopas.fi) Before filling in the application, the student must have the studies approved as part of his/her official personal study plan (HOPS). A copy of the study plan and an unofficial transcript should be enclosed with the application.

Both student's home school and the receiving school or university will electronically make their own decisions in the system, and the student will get the final decision via e-mail.

Further information

Detailed information both internal mobility and JOO studies can be found from Into-website:<https://into.aalto.fi/display/enmobility/Homepage>

International Studies

The students at the School of Engineering can develop their global competence in many ways, e.g.:

- studying abroad as exchange students
- studying on a summer course abroad
- conducting practical training abroad
- working on their master's thesis abroad
- applying to an English Master's programmes, being a student tutor for international students etc.

Student Exchange

During your degree studies at Aalto University School of Engineering you have an opportunity to go to international student exchange. This means that you can study for a semester or a full academic year (3-12 months) in a university abroad. Aalto University promotes full-time exchange studies that may be integrated into the degree of the student. Most exchange periods are realized through exchange programmes. Students can also look for a suitable host university independently (free mover exchange).

Student Exchange Programmes at Aalto University:

- NORDTEK/Nordplus – Nordic countries
- Erasmus-programme – Europe
- GE4 –network – Asia, North and Latin America
- Bilateral agreements of Aalto University or Schools in technology

Also, there are other international cooperation networks such as Nordic Five Tech (N5T) and Cluster that students may benefit when planning to study abroad.

Application times for student exchange: <https://into.aalto.fi/display/enmastereng/Application+periods>

Master's thesis abroad

Engineering students at Aalto University may also decide to work on their Master's thesis abroad. Students can work on their thesis at

a university or in a company or a research center. Student can also apply for the scholarship when working on his/her Master's thesis abroad. To apply, students must submit a free mover application during the application rounds for student exchanges and include the requisite additional materials. Before application, please discuss the possibility and your plans with your professor. You also need to have a contact and thesis supervisor from the exchange university.

Summer Courses abroad

You can study in a summer course or at a summer school abroad during the Aalto University summer break. Depending on the available resources, the School of Engineering may award travel grants for studies in certain summer schools.

Practical Training abroad

For degree students of Aalto University, practical training abroad is an excellent alternative to exchange studies. As a degree student, you may be eligible for Aalto University Career Services' scholarships.

Transferring credits

One of the ground rules of student exchange is that students may transfer all the studies completed abroad to their degree at Aalto University. Therefore, all students participating in Aalto University student exchange programmes as well as the students granted an Aalto University scholarship for studying abroad are required to present a personal study plan before their departure. This ensures that student can transfer the credits completed abroad without difficulties to the degree.

Contact information

For further information, please contact International Student Services (K1 Building, Otakaari 4).

- Outgoing exchange students: Planning officer Mirka Jalonen (mirka.jalonen@aalto.fi), room K104b
- Incoming exchange students: Administrative assistant Hannele Pietola (hannele.pietola@aalto.fi), room K104b

Doctoral Studies

Degrees

A doctoral candidate is a student pursuing further studies after having attained a Master's degree. The postgraduate degrees offered by the Aalto University schools of technology are:

- Licentiate of Science (Technology)
- Doctor of Science (Technology).

The doctoral degree may be taken directly after the master's degree; it is not compulsory to take the licentiate degree first. In special circumstances, the Aalto University Schools of Technology may also award the Doctor of Philosophy degree. It is not, however, possible to take the Licentiate of Philosophy degree at the Schools of Technology.

The Licentiate of Technology degree takes an estimated 2 years to complete, while the Doctor of Science (Technology) and Doctor of Philosophy degrees both take approximately 4 years. A postgraduate degree comprises theoretical studies and research work. The emphasis is on scientific research.

Doctoral studies

The purpose of doctoral studies is for the student to acquire more profound scientific knowledge and skills in scientific research and their practical application than is provided by master's degree studies. The key element in doctoral studies is to acquire the skills required in research and the application of research results. High-level research is a prerequisite for doctoral studies and researcher training.

The aim of doctoral studies is that the student:

- acquires profound knowledge of his or her research field and its social significance and achieves the necessary skills to independently and critically apply the scientific methods of the respective field and produce new scientific knowledge;

- acquires thorough knowledge of the development, basic problems and research methods of his or her research field; and
- achieves a sufficient level of knowledge in the theory of science and other fields related to his or her research field to enable him or her to follow their development.

Applying for doctoral studies

The School of Engineering has two annual application cycles for doctoral studies: in April and in October.

The admission criteria for doctoral students are:

- prior academic success;
- potential for a researcher career: research-related work experience, conference presentations, journal articles etc.
- suitability of the research topic: relevance of the topic for the research focus area of the department;
- research proposal: the feasibility of the research proposal (its quality, workability, organisation);
- time management and resources: the feasibility of the study plan and the time available for the doctoral studies in the next four (4) years;
- other grounds presented by the applicant.

Successful candidates for doctoral studies must have earned the master's degree with an average grade of 3.0/5 and completed the master's thesis with the grade of 3/5. Those with a master's degree earned in accordance with the degree regulations of 1995 or an earlier time when the bachelor's and master's degree were not pursued separately, are required to have completed the courses towards their major, which form the basis of eligibility for doctoral studies, with an average grade of at least 3.0/5. The same requirements apply to degrees earned elsewhere in Finland or abroad. Students who fail to meet these minimum grade criteria but are otherwise suitable for doctoral studies may improve their grades by taking courses, or exceptionally the School may set prerequisites for doctoral studies.

Further information about doctoral studies, admission requirements etc is available at: <https://into.aalto.fi/display/endoctoraleng/Homepage>

MASTER'S PROGRAMMES

Aim and Structure of the Higher University Degree

The School of Engineering follows a two-phase degree structure. The students first complete a lower degree (Bachelor of Science in Technology) and then a higher degree (Master of Science in Technology).

The degrees consist of courses, and the extent of a course is expressed in credits. The average number of hours demanded by one academic year of studies, 1600 hours, is equivalent to 60 credits. The Bachelor's degree consists of 180 credits. This means that it is possible to acquire the degree after three years of full-time studying. The Master's degree (Master of Science in Technology) consists of 120 credits. This means that it is possible to acquire the degree after two years of full-time studying.

The education leading to basic degrees is planned and organized so that students graduating from the degree programmes will be able to work in areas requiring technical and scientific expertise.

Aim of Higher University Degree

Studies leading to the Master's of Science degree shall provide the student with

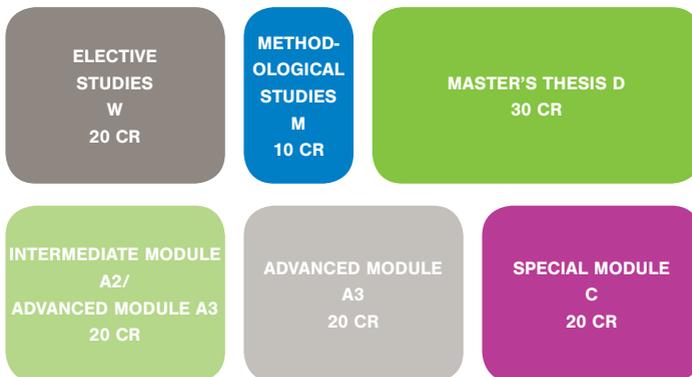
- good overall knowledge of the major subject of the degree programme;
- knowledge and skills needed to apply scientific knowledge and scientific methods, and capability to lifelong, flexible learning;

- knowledge and skills to understand the problems of his/her own field, from the point of view of the user, of technical and social organisations, and of the environment;
- knowledge and skills to operate as an expert and developer of the field in working life;
- good language and communication skills, as well as
- knowledge and skills needed for scientific postgraduate education.

Structure of Higher University Degree

The studies leading to the Master of Science degree consist of

- three modules, at least one of which shall be an advanced module (level 3) in one of the major subjects of the student's own degree programme;
- studies of methodological principles (9-11 credits);
- elective studies (at least 20 credits), and
- Master's thesis (30 credits).



In Master's Programme, the modules to be completed are determined in the study programme and they are confirmed in the personal study plan (HOPS).

Advanced and Special Modules

A Master's programme is based on focused subject studies which for the Intermediate, Advanced and Special Modules. In the Master's

programmes of the Degree Programme in Industrial Engineering and Management, the contents of one of the Special Modules depend on the student's background.

The student's major subject is determined by the Master's programme he/she studies in. There is no minor subject in the Master's programmes.

Methodological Principles

The purpose of the Methodological Principles module is to support writing one's Master's thesis. Some of the courses to be included in the methodological principles module are determined beforehand, and some of them the student can choose from the methodological principles list.

Master's thesis

Master's thesis shall be written on a topic related to the major and agreed upon together with the student and the professor whose field of speciality includes the topic. Further information on Master's thesis can be found in Chapter 7.

Elective Studies

Students are free to choose courses for their Elective studies module (20 cr). Elective studies module can also include practical training. Also, the language studies are included in the module.

Obligatory foreign language courses/tests

According to the Degree Regulations a student shall demonstrate written and oral skills in at least one foreign language included in the curriculum and needed for practicing his/her profession. Language proficiency is demonstrated by passing a course or courses in the foreign language provided by the Language Center. If a student has demonstrated his/her language proficiency by completing foreign language courses already for the Finnish B.Sc or other lower university or polytechnic degree, he/she does not need to demonstrate it again for the Master's degree.

More information about the language courses can be found on the Language Center website <http://languagecentre.aalto.fi/en/>

Creative Sustainability

Creative Sustainability is a cross-disciplinary two-year Master's programme offered by Aalto University's School of Arts, Design and Architecture, School of Engineering (Real Estate Economics) and School of Economics.

The programme presents a wide range of current scientific knowledge relating to urban and industrial sustainability with corporate responsibility. It educates and encourages re-thinking in design, architecture, business management, industrial management and real estate.

The Master's Degree Programme in Creative Sustainability brings together students from different fields to study in multidisciplinary teams that increases understanding of different disciplines and enables adapting a holistic approach. This activates students to create new sustainable solutions for human, urban, industrial and business environments. The pedagogy is based on integrating teaching and research, problem-based learning, blended learning and strong connection to practical outcomes.

In the School of Engineering, it is possible to study in this programme towards the degree of Master of Science (Technology), with a major in Creative Sustainability in Real Estate.

The courses take place in the three different campuses of Aalto University: in Arabia campus (Helsinki), in Töölö campus (Helsinki) and in Otaniemi campus (Espoo).

Degree Structure for CS students of the School of Engineering 2013 - 2014

M161-2 Intermediate Module in Creative Sustainability (20 cr)

Code	Name	Cr
cs0017	Creative Teamwork (ARTS)	2
cs0002	Creating the Mindset of Sustainable Societies (ARTS)	2
cs0003	Continuous Transformation (ARTS)	2
cs0024	Systems Thinking 1 (ARTS)	2
cs0025	Systems Thinking 2 (ARTS)	2
Maa-20.3404	Real Estate in Theory and Practice (ENG)	5
Maa-20.3395	Sustainable Real Estate Business (ENG)	5

ARTS= School of Arts, Design and Architecture, BIZ=School of Business, ENG=School of Engineering. Professor in charge Kauko Viitanen.

M162-3 Advanced Module in Creative Sustainability in Real Estate (18-22 cr)

Code	Name	Cr
A-9.3600	Sustainable Building Design (ARTS)	10
A-36.3600	Sustainable Urban Design (ARTS)	10
MA-94.3601	Sustainable Landscape (ARTS)	9-12
	OR	
21E10000	How to Change the World: Innovation Toward Sustain. (BIZ)	6
21E11000	Corporate Responsibility in Global Economy (BIZ)	6
21E12000	Sustainability Politics and CSR -reading seminar (BIZ)	6

Professor in charge Kauko Viitanen.

M160-3 Advanced Module in Creative Sustainability in Real Estate (20 cr)

Code	Name	Cr
Maa-20.3375	International Land Management (ENG)	6
Maa-20.3401	Corporate Real Estate Management (ENG)	5
Maa-20.3402	Real Estate Development (ENG)	5
Maa-20.3403	Game in Urban Planning and Development (4-6) (ENG)	4

Professor in charge Kauko Viitanen.

M-901-M Methodological Principles (10 cr).

Professor in charge: Kauko Viitanen.

Elective studies (about 20 credits)

For free elective studies students can study courses offered by Aalto University or by other universities as it is possible by Aalto internal and inter institutional agreements and procedures and course specific prerequisites.

Students may also take other CS programme courses for free elective studies, for example:

- 21E10002 How to change the World: Sustainability project, 6 cr
- Yhd-12.3081 State of the World and Development, 2 cr
- Yhd-12.3095 Sustainable Communication, 2 cr
- Yhd-12.3086 Sustainable Global Technologies, changing course, 6 cr
- 21E13000 Special topics in Creative Sustainability: Sustainability Marketing and Consumption, 6 cr

Finnish or Swedish language courses are also recommended for elective studies for international students.

Foreign language studies (minimum 3 cr) are required for the completion of the MSc (Tech) degree. Both oral (o) and written (w)

language skills should be demonstrated in the same language. In the master's programme these studies can be either part of elective studies or methodological studies depending on the course. The following English language courses are recommended for master's programme students:

- Kie-98.1310 Introduction to Academic Communication for Master's Programs in English (o,w) 3 cr (I-II, II-III, III-IV)
- Kie-98.1320 Writing for Master's Students (w) 3-5 cr (I-II, III-IV)
- Kie-98.1410 Industrial Communications (o,w) 3-5 cr (I, IV)

Please, see Language Centre's web site for the full list of courses that fulfill the foreign language requirement.

Finnish or Swedish language courses are strongly recommended for elective studies for international students.

Master's thesis (30 credits).

Please, check the formal procedure of completing the master's thesis (topic, supervisor, maturity test, presentation and graduation).

Environomical Pathways for Sustainable Energy Engineering

Sustainable energy services are one of the key issues for humanity, considering the complete environmental footprint for the services delivered. The SELECT Masters programme starts from the concept basic renewable energy sources (sun, geothermal and moon driven tides) to establish the environomical pathways towards a future sustainable energy system. The SELECT curriculum emphasises the thermodynamic tools of energy and thermoeconomic analysis for training the future energy engineers in advanced well-to-wheel analysis. Sustainability analysis and problem solving, as well as effective knowledge-driven decision making in complex energy systems, are integrated in the curriculum.

Through an introductory two term curricula at KTH, TU/e or at UPC, the concepts of renewable energy, sustainable power generation and environomical pathways are introduced. High-level training in project work and interactive seminars are used for enhanced learning processes. For term three, the students select a focus area to be studied at one other university: e.g., biomass, solar, polygeneration, and fuel cells. In the fourth (final) term the students can perform the MSc thesis in an industrial setting in common supervision with researchers from any of the participating universities

Major: IA3025 Innovative and Sustainable Energy Engineering

Professor in charge: Mika Järvinen

Modules:

- Intermediate Module in Energy Systems 60cr
- K337-3 Advanced Module in Biomass (Select Erasmus Mundus) 60cr

Intermediate Module in Energy Systems 60 cr

Semester	Semester
KTH	
MJ2490 Environomical Pathways, 6 ECTS	MJ2491 Environomical Pathways, Advanced course, 9 ECTS
MJ2411 Renewable Energy Technology, 6 ECTS	MJ2410 Energy Management, , 6 ECTS
MJ2405 Sustainable Power Generation, 9 ECTS	MJ2492 Advanced Renewable Energy Systems Technology, 15 ECTS
MJ2407 Sustainable Energy Utilization, 9 ECTS	
Project of the Year, 7 ECTS	
= 30 ECTS	= 30 ECTS

K337-3 Advanced Module in Biomass

Semester	Semester
Aalto	
Ene-47.5120 Combustion and gasification technology I P, 3 ECTS	Master Thesis, 30 ECTS
Ene-47.5121 Combustion and gasification technology II P, 3 ECTS	
Ene-47.4112 Power Generation from Biomass II b ,3 ECTS	
Ene-47.4114 Waste to Energy, 3 ECTS	
Ene-47.4150 Project in New Energy Technologies 5 ECTS	
Ene-59.4201 Energy markets , 5 ECTS	
Kie-98. Foreign language studies, 3 ECTS	
= 25 ECTS	

Geoinformatics

The Master's Programme in Geoinformatics is a two-year programme (120 ECTS) leading to a Master of Science degree with major in Geoinformation Technology. The courses are offered by the Geomatics Research Group (GMA). The programme focuses on geovisualization, spatial data analysis, spatial data structures, algorithms and spatial programming, as well as GIS software engineering and application development.

The programme offers students both theoretical and practical abilities on the core topics of spatial information processing, analysis, visualization and management. Students of the programme learn to design and implement small GIS-applications as well as apply spatial analysis methods to data sets in order to support decision making. The students learn basic skills in map design and the general rules of good spatial visualization. The students of the programme will be able to use and apply the available GIS-tools in tasks given.

The programme is small and gives opportunities for individual guidance and personal contacts to the teachers and researchers. Geoinformatics is a modern field of science related with computers, communication technologies, mobile and location aware applications, applied mathematics and statistics and decision making tools. The applications of GI-science can be environmental, hydrological, geological, geographical, archeological, planning, security and safety. There are no limits in applications since everything in the world is related to space and time and Geoinformatics is spatio-temporal analysis and modelling.

GIS courses have been offered at Helsinki University of Technology (nowadays Aalto University) since the early 80's, and the Geomatics Research Group has active contacts with the top international universities teaching GIScience. GMA researchers and teachers are active members of international associations and cooperate with colleagues from various countries.

Degree structure

Professor in charge: Kirsi Virrantaus

M152-2 Intermediate Module in GIS and Geocomputation (20 cr)

The student learns to know the most important spatial algorithms and data structures and becomes able to apply them in spatial programming tasks. Depending on the prior knowledge on Geodesy and Computer Science, s/he learns theoretical grounds and most important methods on reference and coordinate systems as well as positioning and navigation or data base management and software engineering.

Code	Name	Teaching period	cr
Maa-123.2340	Spatial Data Algorithms	III-IV	6
Maa-123.2441	GIS Software Development (3-5 op)	II	4
	AND		
Maa-6.3261	Engineering Geodesy	I-II	5
Maa-6.3288	GIS and Geodetic Measurement	I-II	5
	OR		
T-76.1143	Tiedonhallintajärjestelmät	I	5
T-76.3601	Introduction to Software Engineering	III-IV	5

Professor in charge Kirsi Virrantaus.

M124-3 Advanced Module in Geoinformatics (20 cr)

After passing the courses of this module the student has good overview on the computational and visual methods of spatial analysis as well as the methods of design and implementation of GIS applications. the student can apply the most important methods in problem solving and decision making support. In addition the student can design and implement GIS applications by utilizing either commercial or open source software tools.

Code	Name	Teaching period	cr
Maa-123.3510	GIS Analysis and Modelling	I-II	5
Maa-123.3530	Visual Analysis in GIS	II	4
Maa-123.3520	Principles of Geostatistics	II	3
Maa-123.4570	GIS Application Development	I-IV	8

Professor in charge Kirsi Virrantaus.

M129-C Special Module in Geoinformatics (20 cr)

The special module extends the students view on applying computational methods in spatial data modelling and analysis. On the course the student learns the spatial extensions of fuzzy modeling, data mining and data base management, both in theory and in practical exercises. The student is able to recognize the meaning of the quality as well as the sources of the uncertainty related with the results given by the computational methods. The student can also identify both analytical and simulation based methods in uncertainty estimation. An individual assignment is made as a part of the seminar work.

Code	Name	Teaching period	cr
Maa-123.3410	Fuzzy Modelling of Geographic Information	II	4
Maa-123.3420	Advanced Computational Methods in GIS	IV	4
Maa-123.3560	Uncertainty in Geographic Information	I-II	4
Maa-123.3585	Spatial Data Mining (3-5)	IV	4
Maa-123.3590	Seminar on Geoinformatics	IV	4

Professor in charge Kirsi Virrantaus.

OR

M130C Special Module in Cartography (20 cr)

In the special module the student deepens his/her understanding on cartography and learns both the theory of cartography and modern geovisualization. An special emphasis is on the methods of cartographic generalization and the laws of visual map design. The students learns to recognize the processes of topographic and hydrographic mapping and the methods used. An individual assignment is made as a part of the seminar work.

Code	Name	Teaching period	cr
Maa-123.3430	Visualisation of Geographic Information	I-II	5
Maa-123.3470	Web Map Project	III	3
Maa-123.3461	Topographic Data and Maps	IV	6
Maa-123.3450	Hydrography	II	2
Maa-123.3490	Seminar on Cartography	IV	4

Professor in charge Kirsi Virrantaus.

M902-M Methodological Principles (9-11 cr)

Code	Name	Teaching period	cr
Maa-0.3001	Methodology of Surveying Sciences *	IV	5

* Recommended course. List of methodological courses:
<https://into.aalto.fi/display/fimastereng/Tieteen+metodiikan+opinnot>. Professor in charge Kirsi Virrantaus.

M902-W Elective Studies (about 20 cr)

M902-D Master's Thesis (30 cr)

Managing Spatial Change

This multidisciplinary Master's programme (120 credits) prepares future professionals for the challenges of future spatial development at all scales. Students will be provided with an education in responsible strategic spatial planning and management of our living environments. The programme will develop new kinds of work orientation and competencies.

The **two majors** in the programme are:

- Managing Spatial Change, Land Economy concentrates on the role and use of land, real estate and environment within an economy. In particular, it applies the disciplines of real-estate economics, law, GIS and planning for analysing the management of land use, urban areas and interactions with other environmental resources.
- Managing Spatial Change, Urban Engineering concentrates on urban infrastructure and its role within planning and development. It applies disciplines relating to civil and environmental engineering for the analysis and planning of urban areas. In particular, these include transportation-system planning, environmental engineering and policy.

The objective of the programme is to create skilled managers of spatial environment: professionals with a comprehensive understanding of the complexity of spatial challenges; a capacity to integrate spatial planning techniques from different disciplines; and a capacity to implement policies that represent the interests and realities of all stakeholders. Graduates will be able to understand the general cultural importance of the environment and to promote strategic and sustainable development. A comprehensive vision of spatial development based on efficient and sustainable use of resources, good management, inclusiveness and resilient investment will be fostered throughout the studies.

Degree structures

Major: ENG3035 Managing Spatial Change, Land Economy

Professor in charge: Raine Mäntysalo

M163-2 Intermediate Module in Managing Spatial Change (18-22 cr)

Code	Name	Teaching period	Cr
Maa-78.3330	Urban Systems	III-V	5
Maa-20.3375	International Land Management	I-II	6
Maa-78.3320	Strategic Urban and Regional Planning	I	4
Yhd-71.3225	Transportation System Planning (5-6 op)	I-II	5
Professor in charge Raine Mäntysalo.			

M164-3 Advanced Module in Land Economy (18-22 cr)

Code	Name	Teaching period	Cr
Maa-20.3402	Real Estate Development *	III	5
Maa-20.3403	Game in Urban Planning and Development*	IV	4
Maa-20.3404	Real Estate in Theory and Practice**	I	5
Maa-123.1320	Geoinformatics for Real Estate	III	5
Maa-123.3430	Economics**	I-II	5
Maa-123.3510	Visualisation of Geographic Information	I-II	5
Yhd-73.3216	GIS Analysis and Modelling Natural Resources and Environmental Impacts	IV	7
*-courses are compulsory. **-courses are compulsory if equal courses are not completed before. Only one course can be chosen of these two courses: Maa-123.3510 or Maa-123.3430. Professor in charge Kauko Viitanen.			

M165-C Special Module in Managing Spatial Change (18-22 cr)

Code	Name	Teaching period	Cr
Maa-20.3520	Shared Project A, Spatial Planning V	I-II	8
Maa-20.3530	Shared Project B, Land Economy V	III-IV	6
Yhd-71.3280	Shared Project C, Urban Engineering V	I-II	6
Professor in charge Raine Mäntysalo.			

M901-M Methodological Principles (9-11 cr)

Code	Name	Teaching period	Cr
Maa-20.3408	Seminars in Real Estate and Planning	I-II, III-IV	5
List of methodological courses: https://into.aalto.fi/display/fimastereng/Tieteen+metodiikan+opinnot . Professor in charge Raine Mäntysalo.			

M901-W Elective Studies (about 20 cr)

Code	Name	Cr
Yhd-10.3210	Geometric Design of Roads and Streets (recommended course)	3

M901-D Master's Thesis (30 cr)

Please, see more information: <https://into.aalto.fi/display/enmsc/Homepage>

Major: ENG3036 Managing Spatial Change, Urban Engineering

Professor in charge: Tapio Luttinen

M163-2 Intermediate Module in Managing Spatial Change, 20 cr,

Professor in charge: Raine Mäntysalo

Learning outcome of the module: Students will have a sound basic knowledge about different disciplinary approaches, tools and techniques in addressing the problems in managing spatial change.

Code	Name of the course	cr
A-36.3330	Urban Renewal Studio P	5-10
Maa-78.3220	Strategic Urban and Regional Planning	4
Yhd-71.3225	Transportation System Planning	5
Maa-20.3375	International Land Management P	6

R217-3 Advanced Module in Urban Engineering (20cr),

professor in charge Tapio Luttinen

Learning outcome of the module: Students will have knowledge about advanced expert tools and techniques available in the discipline of transportation and environmental engineering in addressing the problems in managing spatial change.

code	Name of the course	cr
Yhd-71.3270	Urban Transport Systems	5
Yhd-73.3216	Natural Resources and Environmental Impacts	7
Yhd-33.3011	Geology and Geotechnics for Regional Planners	4
Yhd-12.3210	Watershed Engineering	5

M165-C Special Module in Managing Spatial Change, 20 cr,

Professor in charge: Raine Mäntysalo

The core learning element of the MSC programme is provided by the Shared Project. The Shared Projects are defining a comprehensive and challenging planning problem, which will help to explore the multidisciplinary dimensions of planning as a practice. The Shared Project will run over three semesters.

Code	Name of the course	cr
Maa-20.3520	Shared Project A, Spatial Planning	8
Maa-20.3530	Shared Project B, Land Economy V	6
Yhd-71.3280	Shared Project C, Urban Engineering	6

Elective studies (20 cr)

Methodological Principles (10 cr)

Master's Thesis (30 cr)

Mechanical Engineering

During this new two-year programme (120 credits), students will receive multi-disciplinary education of the highest international standard, leading to a MSc degree. Close contact with leading Finnish companies will ensure that advanced skills and knowledge can be applied to relevant industrial problems.

Students will choose three of the following five modules (20 credits each) to form the basis of their studies:

- Product Development
- Mechanics of Materials
- Digital Design and Manufacturing
- Mechatronics
- Innovative Structural Design

Module structures

K410-3 Product Development 20 cr

prof. Kalevi Ekman, prof. Eric Coatanéa

Module emphasis is on interdisciplinary product development by organising a conjoint complex development process including conjoint development of mechanical, electronic and software modules. The emphasis in System Thinking is on the understanding of complex systems behaviour when System Engineering is focusing on organizing and designing the systems. System approach is a combination of this analysis and design perspectives and it gives a special importance to product architecture. This means in practice answering issues such as type of correspondence between functions and components. What level of modularity and platform consideration to apply to the system designed? The students are applying the knowledge gathered in the product development and system approach in concrete project oriented courses.

Course code	Name	cr
Kon-41.4001	Product Development	5
Kon-41.4011	System thinking and system engineering	5
Kon-41.4002	Product Development Project	10

K420-3 Mechanics of Materials 20 cr

prof. Gary Marquis, prof. Hannu Hänninen

The module aims at learning and applying methods for advanced component and structure dimensioning, analysis and testing. This includes courses on the finite element method, fatigue and fracture assessment and material modelling.

Course code	Name	cr
Kul-49.4100	Finite Element Method II	5
Kul-49.3400	Dynamics of Structures	5
Kul-49.4350	Fatigue of Structures	5
Kul-49.4501	Continuum Mechanics and Material Modelling	5
Kon-67.4403	Advanced Fracture Mechanics	5
Kon-67.4206	Design and Analysis of Welded Structures	3
Kul-49.4207	Design and Analysis of Welded Structures Project	2

K430-3 Digital Design and Manufacturing 20

prof. Kalevi Aaltonen

This module focuses on computer aided design (CAD), computer aided engineering (CAE) and digital manufacturing including welding and casting. The aim is to learn to apply digital design methods and tools in an integrated design-manufacturing and product life management (PLM) process.

Course code	Name	cr
Kon-41.3006	Computer Aided Design Basic Course	5
Kon-41.4207	CAE Project	3
Kon-15.4101	Digital Manufacturing	4
Kon-67.4208	Welding Methods and Production	4
Kon-80.3125	Castings	4

K440-3 Mechatronics 20 cr

prof. Petri Kuosmanen, acting prof. Jari Juhanko

Students learn the working principles of mechatronics components and systems. Project and team work approaches are used to help students to learn and apply machine design process principles in the design of mechatronic systems.

Course code	Name	cr
Kon-41.3140	Mechatronics Sensors and Actuators	4
Kon-41.3131	Mechatronics Exercises	4
Kon-41.4151	Mechatronics Machine System Design	4
Kon-41.4160	Mechatronics Project	8

K450-3 Innovative Structural Design 20 cr

professor of practice Pentti Kujala, prof. Olli Saarela

This module includes courses on design and assessment of composite, lightweight and large complex structures. Structural reliability and optimisation, with respect particularly to ship structures and aircraft engineering, are emphasized.

Course code	Name	cr
Kul-34.3600	Composite Structures	5
Kul-34.4700	Lightweight Structures	5
Kul-24.4200	Introduction to risk analysis of structures	5
Kul-24.4511	Optimization of Structures	5
Kul-24.4710	Complex Structures	5

K460-C Individual Study Module 20 cr

prof. Gary Marquis

Individually selected contents, module and course selection always requires advance approval by the responsible professor. Detailed information about these modules, contents etc. <https://into.aalto.fi/display/enmech/Homepage>

Minerals and Environmental Engineering

Erasmus Mundus Minerals and Environmental Programme EM-MEP (in Aalto University: Master's Degree Programme in Minerals and Environmental Engineering) is a 2-year Master's programme organized in international cooperation. The programme educates new talent, future managers and leaders in the European and world-wide minerals industry. It is taught at multiple locations in Europe and offers for its graduates a double MSc degree. The Aalto University School of Engineering provides courses for the programme's major European Mining Course (EMC). During the academic year 2013-2014 the EMC studies take place in the following institutions:

- Aalto University, Finland
- RWTH Aachen, Germany
- Delft University of Technology, the Netherlands

(TU Delft is the coordinating university of the programme)

The students who participate to the programme study together in three different European countries and universities for one year. During the second year of the programme students study in two of these insitutions.

As a degree seeking student of Aalto University, you can apply to study in the Master's degree programme in Minerals and Environmental Engineering. TU Delft coordinates the application procedure and application requirements. Please, note that students wishing to enter to the programme are required fulfill all the entrance requirements including the international English language test such as TOEFL or IELTS with a set score. The deadline for complete applications is 1 April 2014.

Programme courses during academic year 2013-2014

University	Name of the Course	ECTS
Aalto University	Applied Rock Mechanics for Hard Rock Mining	3
Aalto University	Automation and Maintenance of Mining Equipment	3
Aalto University	Mining Technology and Economics	3
Aalto University	Numerical Mine Modelling	3
Aalto University	Mine Excursion	3
RWTH Aachen	Mine Ventilation	6
RWTH Aachen	Open Pit Mining	6
RWTH Aachen	Environmental Issues	3
TU Delft	Mineral Resources Definition	2
TU Delft	Resource Modelling, Reserve Estimation and Reporting Codes	4
TU Delft	Mine Planning and Optimization	2
TU Delft	Applied Rock Mechanics for Mining	4
TU Delft	Safety	2
TU Delft	Alluvial Mining and marine Mining	3
TU Delft	Case Study	9
TU Delft	Industrial Minerals	2
TU Delft	Mineral Economics	2

See also home page: <http://www.femp.org/>

Real Estate Investment and Finance

Real estate investments represent a large share of the wealth universe as well as of the portfolios of institutional investors, being thus an important field of specialisation in finance. Due to the special characteristics of real estate investments, operating in the real estate business requires knowledge of the functions and processes on the markets. This is what the Real Estate Investment and Finance programme at Aalto is about.

The Master's programme in Real Estate Investment and Finance is a two-year (120 ECTS) programme leading to a Master of Science (Tech) degree. The programme courses are offered by Aalto University Department of Real Estate, Planning and Geoinformatics.

The programme offers a holistic understanding of the operations in real estate markets and investments. After the programme, you are able to perform investment analyses of individual real estate investments and portfolios, and conduct market analysis. In addition, you gain knowledge on real estate management, development and the relevant legislation related to real estate. The programme combines theoretical knowledge with extensive hands-on work in assignments and case studies.

The programme provides a Master's degree of international standard and quality that gives the students the required knowledge to work in the fields of real estate and financial intermediation. The programme prepares students to professional positions in real estate, such as real estate analyst, commercial advisor, real estate manager and researcher.

You will study:

- Analysis of real estate investments and portfolios, both in theory and practise
- Theories and their use in explaining the dynamics of real estate markets
- Operations and roles of different actors, such as real estate investor, developer and agent.

Major: (M3009) Real Estate Investment and Finance

Professor in charge: Kauko Viitanen

M134-2 Intermediate module in Real Estate Investment and Finance (20 cr)

Code	Name	Teaching period	cr
Maa-20.3337	Commercial Property market and Valuation	I-II	5
Maa-20.3344	Introduction to Real Estate Investments	I	5
Maa-20.3345	Urban Economics for Real Estate	II	5
Maa-20.3404	Real Estate in Theory and Practice	I	5

Professor in charge Kauko Viitanen.

M135-3 Advanced module in Real Estate Investment and Finance (20 cr)

Code	Name	Teaching period	cr
Maa-20.3341	Real Estate Investments Analysis (4-8 cr)	II	5
Maa-20.3401	Corporate Real Estate Management	IV	5
Maa-20.3402	Real Estate Development	III	5
Maa-20.3409	Real Estate Finance I	III	5

Professor in charge Kauko Viitanen.

M136-C Special module in Real Estate Investment and Finance (20 cr)

Code	Name	Teaching period	cr
Maa-20.3303	Theories in Real Estate Economics V (5-10)	IV-V	10
Maa-20.3343	Analysis of Real Estate Assets and Vehicles	I	6
Maa-20.3403	Game in Urban Planning and Development (4-6)	V	4

Professor in charge Kauko Viitanen.

M901-M Methodological Principles (10 cr)

Code	Name	Teaching period	cr
Maa-20.3407	Research Methods for Real Estate *	I	5
Maa-20.3408	Seminars in Real Estate and Planning	I-II, III-IV	5

*Course is compulsory. Professor in charge Kauko Viitanen.

M901-W Elective Studies (about 20 cr)

M901-D Master's Thesis (30 cr)

Please, see more information <https://into.aalto.fi/display/enkta/>
Homepage

Structural Engineering

The Master's Programme in Structural Engineering provides students with a solid knowledge of the analysis and design of structures that support or resist loads and actions. The programme includes also courses of building physics, ageing management of structures, construction economics and management as well as building materials technology and building services technology.

The programme offers a robust theoretical basis for the practical needs of working life. Studies consist of lectures, exercises as well as laboratory experiments. Part of these may be carried out as projects and seminars training students to industrial applications and working practices.

The Master's Programme in Structural Engineering offer also the possibility of completing part of the studies in a Cluster partner university. Currently, Aalto University has a Cluster dual Master's degree agreement with Technical University Darmstadt in Germany. In the Cluster dual degree programme, the second autumn semester of the Master's programme is completed at the partner university. The Master's thesis is supervised by both universities and the student graduates from both universities.

Degree structure

Major: ENG3039 Structural Engineering

Professor in charge: Jari Puttonen

R218-3 Advanced Module in Structural Engineering (19-20 op)

Code	Name of the course	cr
	Compulsory	
Rak-54.3110	Plate and Shell Structures	5
Rak-11.3001	Design of Bridges	6
Rak-43.3111	Prestressed and Precast Concrete Structures	5
Rak-43.3121	Wood structures II	4
Rak-83.3110	Steel Structures II	4

R331-C Special Module in Structural Engineering (21 op)

Code	Name of the course	cr
	Compulsory	
Rak-83.3200	Composite Structures	4
Rak-54.3310	Stability of Structures	5
	Choose 12 cr	
Rak-11.3200	Bridges, Special Course	4
Rak-11.3300	Bridge Design Exercise	4
Rak-43.3301	Repair methods of Structures I	4
Rak-43.3312	Repair methods of Structures II	4
Rak-43.3313	Repair methods of Structures, exercise	4

R905 M Methodological Principles (structural engineering)

Code	Name of the course	cr
	Compulsory	
Rak-54.3200	Numerical Methods in Structural Engineering P	5
	Choose 5 cr	

Elective studies (20 cr)***Master's thesis (30 cr)***

More detailed information about programme courses, timetable etc. can be found from Into-website: <https://into.aalto.fi/display/enstr/Programme+courses+at+Aalto>

Nordic Master's Programmes

Master's degree programme in Environmental Engineering

Environmental Technologies and Green Engineering are amongst the fastest growing markets in the world, and there is increasing demand for innovative solutions and many new graduates. The eNviro5Tech joint MSc degree addresses this demand by pooling resources to create the most comprehensive degree in Environmental Engineering in the world.

The eNviro5Tech MSc is offered by the Nordic Five Tech, a strategic alliance of the five strongest technical universities in the Nordic region, with partners in Denmark (DTU), Sweden (KTH, Chalmers University of Technology), Norway (NTNU) and Finland (Aalto University). The program involves a set of 5 predefined study tracks leading to double degrees in Environmental Engineering.

Study track: Environmental Informatics

Professor in charge: Ari Jolma

Civil Engineering Environmental Informatics is the study and development of information and information processing applied to environmental management and civil engineering. The research focus is on models of data and information, on models of processes in the environment, and on combination of the two for problem solving.

Use of the computer has emphasized the requirement to understand and efficiently manage the flow of data from their origin in environmental sensors to databases. Similarly, the need to understand, initiate and manage change both in the environment and in natural and built systems, for the combined good of man and the environment, is increasing. Skills in modeling, implementation of models in software, geospatial analysis and information systems development are characteristic for civil engineers specializing in environmental informatics.

Additionally, it is important that these engineers have an ability to collaborate with and understand the needs of environmental scientists, as well as those people that use the information systems they create.

Intermediate Module in Environmental Informatics

1. Semester	2. Semester
Aalto	
Yhd-102.3350 Environmental Modeling and Decision Support, 5 ECTS	Maa-123.1310 Theories and Techniques of Geoinformatics, 7 ECTS OR Maa-123.1320 Geoinformatics , for Real Estate Economics 5 ECTS OR Maa-123.2340 Spatial Data Algorithms, 6 ECTS
Yhd-102.3321 Environmental Information Systems, 5 ECTS	Yhd-73.3510 Environmental Engineering, 6 ECTS
T-61.3050 Machine learning: Basic Principles, 5 ECTS	31C01300 Environmental Economics 5 ECTS
T-61.3040 Statistical Signal Modeling, 5 ECTS	T-76.3601 Introduction to Software Engineering, 5 ECTS
T-75.1110 XML Based Description Languages, 3 ECTS	Yhd-102.xxx Project in environmental informatics 1-3 ECTS
Kie-98. Foreign language studies, 3 ECTS	Electives 10-15 ECTS: Yhd-12.3210 Watershed Engineering 5 ECTS Yhd-73.3216 Natural Resources and Environmental Impacts 7 ECTS
Electives: Maa-123.3510 GIS Analysis and Modelling P, 5 ECTS or Maa-123.3420 Advanced Computational Methods in GIS P, 4 ECTS	
30 ECTS	30 ECTS

Advanced Module in Environmental informatics

3. Semester	4. Semester
DTU	
02409 Multivariate Statistics, 5 ECTS OR 02585 Computations on Geometric Data, 5 ECTS	Master Thesis DTU, 30 ECTS
15 ECTS chosen from list of DTU Tech Specialization or general competence courses**	
Electives, 10 ECTS***	
30 ECTS	
	30 ECTS

** DTU Tech Specialization course list: See http://www.env.dtu.dk/English/Education/MSc_Environmental_Engineering/Degree%20Structure/Technological%20Specialisation%20Courses.aspx.

*** Recommended electives for study line:

30540 Mapping from Aerial and Satellite Images (5 ECTS)

02457 Nonlinear Signal Processing (10 ECTS)

02459 Machine Learning for Signal Processing (10 ECTS)

Intermediate Module in Environmental Informatics

1. Semester	2. Semester
DTU	
12104 Modelling of Environmental Processes and Technologies, 10 ECTS	30530 Geographic Information Systems, 5 ECTS
42631 Environmental Economics, 5 ECTS	02457 Nonlinear Signal Processing, 10 ECTS
02409 Multivariate Statistics, 5 ECTS	02291 System Integration, 10 ECTS
5 ECTS chosen from list of DTU Tech Specialization or general competence courses*	10 ECTS chosen from list of DTU Tech Specialization or general competence courses*
30 ECTS	30 ECTS

* DTU Tech Specialization course list:

See http://www.env.dtu.dk/English/Education/MSc_Environmental_Engineering/Degree%20Structure/Technological%20Specialisation%20Courses.aspx.

Advanced Module in Environmental informatics

3 Semester	4 Semester
Aalto	
Yhd-102.3310 Environmental Modeling and Decision Support, 5 ECTS	Master Thesis Aalto, 30 ECTS
Yhd-102.3321 Environmental Information Systems, 5 ECTS	
T-61.5140 Machine Learning: Advanced Probabilistic Methods, 5 ECTS OR T-61.5130 Machine Learning and Neural Networks, 5 ECTS	
T-61.3040 Statistical Signal Modeling, 5 ECTS	
Maa-123.3510 GIS Analysis and Modelling, 5 ECTS OR Maa-123.3420 Advanced Computational Methods in GIS 4 ECTS	
Kie-98. Foreign language studies, 3 ECTS	
Elective 2-3 ECTS	
30 ECTS	30 ECTS

See also homepage

<https://into.aalto.fi/display/enenviro/Homepage>

MP20 Nordic Master in Maritime Engineering (NMME)

The Nordic Master in Maritime Engineering is based on the expertise of the participating universities within naval architecture, offshore engineering and maritime engineering. The programme targets international students wishing to profit from the Nordic Five Tech universities' long standing tradition and competence in the field and Nordic students wishing to specialize in a specific area of expertise offered within the alliance.

The education is based on first principles within design, construction and operation of ship and offshore structures, including hydrostatics and stability, hydrodynamics, wave and wind loads and structural analyses. The teaching comprises lectures, assignments, workshops and project work. Theory is supported by experimental work and computer simulations are used intensively.

Aalto University offers for the Nordic Master in Maritime Engineering the study track Passenger ships. This study track gives a comprehensive overview of the different aspects related to the design, analysis and optimization of passenger ships. The studies cover both the basic knowledge as well as application of risk-assessment methods in ship design. The conflicting interests of various stakeholders will be addressed during the studies, and the student is forced to create a solution that satisfies the stakeholder's preferences.

The aim of the studies is to work on the same project ship throughout the specialization semester and work on different parts of this ship during different courses. The courses taken will be chosen so that they support the project work. This way obtained knowledge and know-how will be at the same time deep and synthesized. In addition the student is forced to plan the time spent on different parts giving the student capability to work on challenging projects with limited resources.

After the graduation the student could be located at the shipyard design department, at design offices, classification society, etc.

Study track: Ocean structures

Intermediate Module in Maritime Engineering in Ocean structures

1 Semester	2 Semester
Aalto	
Kul-24.3100 Ship conceptual design 5 ECTS	Kul-24.4120 Ship structural design 5 ECTS
Kul-24.3200 Introduction to marine hydrodynamics 5 ECTS	Kul-24.4140 Ship dynamics 5 ECTS
Kul-24.3300 Ship buoyancy and stability 5 ECTS	Language studies/Scientific methodology 5 ECTS
Kul-24.4200 Introduction to risk analysis of structures, 5 ECTS	Electives list 2 15-20 ECTS
Language studies/Scientific methodology 5 ECTS	
Electives list 1 5-10 ECTS	
30 ECTS	30 ECTS
Electives list 1 Kul-24.4610 Ship performance in ice, 5 ECTS Kul-49.3400 Dynamics of structures, 5 ECTS Kul-49.4100 Finite element method II (even years) , 5 ECTS Kul-49.4150 Finite element method, applications , 3 ECTS Kul-49.4350 Fatigue of structures (odd years) , 5 ECTS Kul-49.4800 Individual assignments in mechanics of materials, 3-6 ECTS Kul-34.4700 Lightweight structures, 5 ECTS	Electives list 2 Kul-24.4310 Arctic offshore structures 5 ECTS Kul-24.4230 Safety and risks of marine traffic 5 ECTS Kon-67.4206 Design and analysis of welded structures 2 ECTS Kul-24.3500 Winter navigation 5 ECTS Kul-49.4250 Models for beam, plate and shell structures (even years) 5 ECTS Kul-49.4800 Individual assignments in mechanics of materials 3-6 ECTS

Advanced Module in Maritime Engineering in Ocean structures

3 Semester	4 Semester
NTNU	
TMR4500 Ocean structures - specialization project 7,5 ECTS	Master Thesis, NTNU 30 ECTS
TMR4505 Specialization courses 7,5 ECTS – modules, select 2 of: - Structural analysis - Dynamic analysis of marine structures - Ice 1 / Ice 2 - Experimental methods in hydrodynamics - Hydro elasticity	
TMR419X Design of offshore structures 7,5 ECTS	
Electives list 1 7,5 ECTS	
30 ECTS	30 ECTS

Electives list 1:

- TMR4115 Design methods 7,5 ECTS
- TMR4130 Risk analysis 7,5 ECTS
- TMR4200 Fatigue and fracture of marine structures 7,5 ECTS
- TMR4235 Stochastic theory of sea loads 7,5 ECTS
- TMR4215 Sea loads 7,5 ECTS

Study track: Small craft

Intermediate Module in Maritime Engineering

1 Semester	2 Semester
Aalto	
Kul-24.3100 Ship conceptual design 5 ECTS	Kul-24.4120 Ship structural design 5 ECTS
Kul-24.3200 Introduction to marine hydrodynamics 5 ECTS	Kul-24.4140 Ship dynamics, 5 ECTS
Kul-24.3300 Ship buoyancy and stability 5 ECTS	Kul-24.4343 CAD in ship conceptual design, 5 ECTS
Language studies/Scientific methodology 5 ECTS	Electives list 2 11-16 ECTS
Electives list 1 5-10 ECTS	
30 ECTS	30 ECTS
Electives list 1	Electives list 2
Kul-24.3400 Ship machinery systems 5 ECTS	Kul-24.4230 Safety and risks of marine traffic 5 ECTS
Kul-24.3500 Winter navigation 5 ECTS	Kul-24.4370 Potential flow theory for lifting 5 ECTS surfaces, extended course
Kul-24.4220 Merchant shipping 3 ECTS	Kul-24.4410 Ship machinery systems II 5 ECTS
Kul-24.4310 Arctic offshore structures 5 ECTS	Kul-24.4520 Computational marine hydrodynamics 5 ECTS
Kul-24.4610 Ship performance in ice, 5 ECTS	Kon-67.4206 Design and analysis of welded structures 2 ECTS
Kul-49.3400 Dynamics of structures 5 ECTS	Kul-49.4250 Models for beam, plate and shell structures (even years) 5 ECTS
Kul-49.4100 Finite element method II (even years) 5 ECTS	Kul-49.4800 Individual assignments in mechanics of materials 3-6 ECTS
Kul-49.4150 Finite element method, applications 5 ECTS	
Kul-49.4350 Fatigue of structures (odd years) 5 ECTS	
Kul-34.4700 Lightweight structures 5 ECTS	

Advanced Module in Maritime Engineering in Small crafts

3 Semester	4 Semester
KTH	
SD3705 High speed craft structural design 6 ECTS	Master Thesis, KTH 30 ECTS
SD2416 Structural optimization and sandwich structures 6 ECTS	
SD2706 Sailing for performance 6 ECTS	
SD2707 Marine innovation 5 ECTS	
Electives 6 ECTS (choose one) SD2415 Process modeling for composite manufacturing SE1025 FEM for engineering applications	
30 ECTS	30 ECTS

Study Track: Ship operations

Intermediate Module in Maritime Engineering in Ship operations

1 Semester	2 Semester
Aalto	
Kul-24.3100 Ship conceptual design 5 ECTS	Kul-24.4120 Ship structural design 5 ECTS
Kul-24.3200 Introduction to marine hydrodynamics 5 ECTS	Kul-24.4140 Ship dynamics, 5 ECTS
Kul-24.3300 Ship buoyancy and stability 5 ECTS	Kul-24.4343 CAD in ship conceptual design 5 ECTS
Kul-24.4200 Introduction to risk analysis of structures 5 ECTS	Kul-24.4230 Safety and risks of marine traffic 5 ECTS
Language studies/Scientific methodology 5 ECTS	Kul-24.4410 Ship machinery systems II 5 ECTS
	Language studies/Scientific methodology 5 ECTS
Electives list 1 5-10 ECTS	Electives list 2 1-6 ECTS
30 ECTS	30 ECTS
Electives list 1 Kul-24.3400 Ship machinery systems 5 ECTS Kul-24.4220 Merchant shipping 3 ECTS Kul-24.4310 Arctic offshore structures 5 ECTS Kul-24.4610 Ship performance in ice 5 ECTS	Electives list 2 Kul-24.3500 Winter navigation 5 ECTS Kul-49.4400 Ice mechanics 5 ECTS Kul-24.4520 Computational marine 5 ECTS hydrodynamics Kon-67.4206 Design and analysis of welded structures 2 ECTS Kon-49.4207 Design and analysis of welded structures, project 2 ECTS

Advanced Module in Maritime Engineering in Ship Operations

3 Semester	4 Semester
DTU	
41216 Structural assessment of ships 5 ECTS	Master Thesis, DTU 30 ECTS
41221 Ship propulsion and manoeuvring 10 ECTS	
41222 Wave loads on ships and offshore structures 5 ECTS	
41275 Ship operations 5 ECTS - Ship operations project work 5 ECTS	
30 ECTS	
	30 ECTS

Study Track: Ship design

Intermediate Module in Maritime Engineering in Ship design

1 Semester	2 Semester
Aalto	
Kul-24.3100 Ship conceptual design, 5 ECTS	Kul-24.4120 Ship structural design, 5 ECTS
Kul-24.3200 Introduction to marine hydrodynamics, 5 ECTS	Kul-24.4140 Ship dynamics, 5 ECTS
Kul-24.3300 Ship buoyancy and stability, 5 ECTS	Kul-24.4343 CAD in ship conceptual design, 5 ECTS
Kul-24.4200 Introduction to risk analysis of structures, 5 ECTS	Kul-24.4230 Safety and risks of marine traffic, 5 ECTS
Language studies/Scientific methodology 5 ECTS	Kul-24.4520 Computational marine hydrodynamics 5 ECTS
	Language studies/Scientific methodology 5 ECTS
Electives list 1 5-10 ECTS	Electives list 2 1-6 ECTS
30 ECTS	30 ECTS
Electives list 1	Electives list 2
Kul-24.3400 Ship machinery systems 5 ECTS	Kul-24.3500 Winter navigation 5 ECTS
Kul-24.4310 Arctic offshore structures 5 ECTS	Kul-24.4370 Potential flow theory for lifting surfaces, extended course 5 ECTS
Kul-24.4610 Ship performance in ice 5 ECTS	Kul-24.4410 Ship machinery systems II 5 ECTS
Kul-24.4220 Merchant shipping 3 ECTS	Kon-67.4206 Design and analysis of welded structures 2 ECTS
Kul-49.3400 Dynamics of structures 5 ECTS	Kon-49.4207 Design and analysis of welded structures, project 2 ECTS
Kul-49.4350 Fatigue of structures (odd years) 5 ECTS	Kul-34.4700 Lightweight structures 5 ECTS
Kul-49.4800 Individual assignments in mechanics of materials 3-6 ECTS	Kul-49.4250 Models for beam, plate and shell structures (even years) 5 ECTS
	Kul-49.4400 Ice mechanics 5 ECTS

Advanced Module in Maritime Engineering in Ship Design

1 Semester	2 Semester
Chalmers	
MMA150 Ship design project 15 ECTS	Master Thesis, Chalmers 30 ECTS
TME260 Fatigue and fractures 7,5 ECTS	
Electives 7, 5 ECTS (choose one): IBB 135 Project management 7,5 ECTS MTT100 Mechanical performance of engineering materials 7, 5 ECTS MTF072 Computational fluid dynamics 7,5 ECTS	
30 ECTS	
30 ECTS	

Study Track: Passenger Ships

Intermediate Module in Maritime Engineering in Passenger Ships

1 Semester	2 Semester
Chalmers	
MMA136 Ship geometry and hydrostatics 7,5 ECTS	SJO740 Marine propulsion systems 7,5 ECTS
MMA127 Marine transport systems 7,5 ECTS	SJO745 Wave loads and seakeeping 7, 5 ECTS
MMA161 Ship resistance and computational hydrodynamics 7,5 ECTS	SJO750 Reliability analysis of marine structures 7,5 ECTS
MMA167 Marine structural engineering 7,5 ECTS	Electives (choose one): 7,5 ECTS TME240 Composite mechanics 7,5 ECTS TME245 FEM-structures 7,5 ECTS
30 ECTS	30 ECTS

Intermediate Module in Maritime Engineering in Passenger Ships

1 Semester	2 Semester
DTU	
41216 Structural assessment of ships 5 ECTS	42490 Technology, economics, management and organization 10 ECTS
41221 Ship propulsion and manoeuvring 10 ECTS	41323 Advanced fluid mechanics 10 ECTS
41222 Wave loads on ships and offshore structures 5 ECTS	Electives: 10 ECTS 41345 Experimental methods in IC engines 5 ECTS 41514 Dynamics of machinery 5 ECTS 41812 FEM light 10 ECTS
41275 Ship operations 5 ECTS	
02431 Risk management 5 ECTS	
30 ECTS	30 ECTS

Intermediate Module in Maritime Engineering in Passenger Ships

1 Semester	2 Semester
KTH	
SD2704 Hull structural design 6 ECTS	SD2710 Initial ship design 8 ECTS
SD2411 Lightweight structures 8 ECTS	SD2711 Small craft design 10 ECTS
SD2707 Marine innovation 5 ECTS	SD2703 Marine dynamics 8 ECTS
SD2706 Sailing for performance 6 ECTS	SG2212 Fluid mechanics, CFD 7,5 ECTS
Electives: ≥5 SD2415 Process modeling for composite manufacturing 6 ECTS SE1025 FEM for engineering applications 6 ECTS SG2214 Fluid mechanics 7,5 ECTS ME1000 Industrial management 6 ECTS	
30 ECTS	30 ECTS

Intermediate Module in Maritime Engineering

1 Semester	2 Semester
NTNU	
TMR4115 Design methods 7,5 ECTS	TMR4125 Shipbuilding 7,5 ECTS
TMR42xx Simulation based design 7,5 ECTS	TMR4135 Advanced vessel design 7,5 ECTS
Electives (choose two): 15 ECTS TMR4130 Risk analysis and safety management in marine transport 7,5 ECTS TMR4215 Sea loads 7,5 ECTS TMR4290 Marine electric power and propulsion systems 7,5 ECTS TMR4275 Modeling, simulation and analysis of dynamic systems 7,5 ECTS TVM4162 Industrial ecology 7,5 ECTS	Elective (choose two): 15 ECTS TMR4220 Naval hydrodynamics 7,5 ECTS TMR4260 Safe operation and maintenance 7,5 ECTS TPK4115 Project planning and control 7,5 ECTS TMR4140 Design of marine production plants 7,5 ECTS TMR4225 Marine operations 7,5 ECTS
30 ECTS	30 ECTS

Advanced Module in Maritime Engineering in Passenger Ships

3 Semester	4 Semester
AALTO	
Kul-24.4110 Ship project A, 5 ECTS	Master Thesis, Aalto 30 ECTS
Kul-24.4130 Shipyard engineering, 5 ECTS	
Kul-24.4200 Introduction to risk analysis of structures, 5 ECTS	
Kul-24.4350 Passenger ship architecture, 5 ECTS	
Kie-98.XXX Foreign Language studies, (min 3 ECTS)	
Electives list 1 7 ECTS	
30 ECTS	30 ECTS

Electives list 1

- Kul-24.3100 Ship conceptual design 5 ECTS
- Kul-24.4310 Arctic offshore structures 5 ECTS
- Kul-24.4610 Ship performance in ice 5 ECTS
- Kul-24.4710 Large complex structures 5 ECTS
- Kul-24.4511 Optimization of structures 6 ECTS

Master's Programme in Innovative and Sustainable Energy Engineering

The purpose of the Nordic Master Programme in "Innovative and Sustainable Energy Engineering" is to provide state-of-the-art education in the fields of conventional and renewable energy sources like conventional and new power generation, solar energy, biomass energy, wind power, geothermal power and energy utilization in the built environment by means of economically and environmentally sustainable systems and technologies.

The term "sustainable energy engineering" comprises a wide array of practices, policies and technologies (conventional and renewable/alternative) aimed at providing energy at the least financial, environmental and social cost. A strong emphasis is placed on dealing with energy engineering tasks with due consideration of technical, environmental and socio-economic issues.

Another strong emphasize is put on the Innovative and Entrepreneurial aspects of the energy society, especially related to how existing and new efficiency improvement innovations can be brought to the market in different countries. The innovative aspects inside the programme are both related to the advanced renewable concept in the Nordic countries as well as regards to new businesses in the energy sector.

The programme will run to some extent with internet based audiovisual educational material allowing students at other campuses to follow lectures.

Major: IA3025 Innovative and Sustainable Energy Engineering

Professor in charge: Mika Järvinen

Modules for Energy Systems:

Intermediate Module in Energy Systems 60cr

Advanced Module in Energy Systems 60cr

Intermediate module in Energy systems

1. Semester	2. Semester
Aalto	
Ene-59.4201 Energy Markets 5 ECTS	Ene-59.4010 Models of Optimization of Energy Systems 5 ECTS
Ene-59.4301 Energy Systems for Communities 5 ECTS	Ene-47.4151 Individual Assignment in Environment Friendly Energy Process 5 ECTS
Tfy-56.4311 New Energy Sources P 5 ECTS	Kje-98. Foreign language studies, 3 ECTS
Ene-47.5130 Process Integration, Simulation and Optimization 3 ECTS	Elective course from list*:
Ene-47.5131 Life-Cycle Assessment and Environmental Auditing P 3 ECTS	Tfy-56.4323 Solar Energy Engineering 5 ECTS
Ene-47.4150 Project in New Energy Technologies 5-7 ECTS	Tfy-56.4332 Fuel Cells and Hydrogen Technology 5 ECTS
Ene-47.5140 Wind Energy P 5 ECTS	Ene-39.4024 Design of Heat Exchangers 5 ECTS
	Ene-47.5122 Pollutant Formation and Control in Combustion 3 ECTS
31-33 ECTS	27-29 ECTS

* Other courses may be available; this can be arranged with local supervisor

Advanced Module in Energy Systems

1. Semester	2. Semester
KTH	
Introduction to Energy-Environment-Economic optimization modeling 9 ECTS	Thesis, 30 cr
MJ2413 Energy and Environment 6 ECTS	
MJ2470 Climate Change Mitigation Tools 6 ECTS	
MJ 2473 Energy Policy Design 6 ECTS 6 ECTS	
Energy Systems Analysis – Minor Project 3 ECTS	
30 ECTC	30 ECTS

Modules for Biomass:

- K335-C Special Module in Innovative and Sustainable Energy Engineering
- K335-3 Advanced Module in Innovative and Sustainable Energy Engineering “Power Generation from Biomass”
- K336-3 Advanced Module in Innovative and Sustainable Energy Engineering “Bioenergy in Transport”
- K335-C Special Module in Innovative and Sustainable Energy Engineering

1. Semester	2. Semester
KTH	
MJ1402 Introduction to Energy Technology, 3 ECTS	MJ2424 Computational Methods in Energy Technology, 6 ECTS
MJ2411 Renewable Energy Technology, 6 ECTS	MJ2410 Energy Management, 6 ECTS
MJ2405 Sustainable Power Generation, 9 ECTS	MJ2412 Renewable Energy Technology, Advanced course, 6 ECTS
MJ2407 Sustainable Energy Utilization, 9 ECTS	MJ2426 Applied heat and power technology, 6 ECTS
MJ2413 Energy and Environment, 6 ECTS	Elective course from list 1
33 ECTS	27 ECTS

Elective course list 1

- Modeling of Energy Systems – Heat and Power Generation
- Climate Change Mitigation Tools
- Energy Policy Design
- Students may choose in Aalto University either: “Power generation from Biomass” or “Bioenergy in Transport” option
- Option Aalto 3a: “Power Generation from Biomass” (Professor in charge: Mika Järvinen)

3. Semester	4. Semester
AALTO	
Ene-47.5120 Combustion and Gasification Technology I, 3 ECTS, I	Thesis 30 ECTS, III-IV
Ene-47.5121 Combustion and Gasification Technology II, 3 ECTS, II	
Ene-47.4112 Electricity Production from Biomass II b, 3 ECTS, II	
Ene-47.5130 Process-Integration, Simulation and Optimization, 3 ECTS, I	
Ene-47.4114 Waste to Energy, 3 ECTS, I-II	
Ene-47.4150 Project in New Energy Technology, 5 ECTS, I-II	
Foreign language course, 3 ECTS, I-II	

Option Aalto 3b: "Bioenergy in Transport"(Professor in charge: Martti Larmi)

3. Semester	4. Semester
AALTO	
Kul-14.4100 Internal Combustion Engine Technology, 5 ECTS, I	Thesis 30 ECTS, III-IV
Kul-14.4700 Transport Biofuels, Combustion and Emission Control, 5 ECTS, II	
KE-40.4120 Introduction to Biorefineries and Biofuels, 5 ECTS, I - II	
Ene-59.4301 Energy Systems for Communities, 5 ECTS, II	
Please, note: course Ene-59.4301 can be replaced by the following courses Ene-47.5120 Combustion and Gasification Technology I, 3 ETCS, I and Ene-47.5121 Combustion and Gasification Technology II, 3 ETCS, II	
Foreign language course, 3 ECTS, I-II	

See also homepage

<https://into.aalto.fi/display/enmisee/Homepage>

