

Curriculum 2017-2018

Learning Outcomes

The Master's Degree programme in Industrial Engineering and Management (IEM) educates engineers who can develop and lead businesses with an entrepreneurial mindset. The programme combines engineering with economic and human fundamentals to create value and efficiency. IEM studies explore the foundations of business and engineering processes and inspire a systemic, solution oriented engineering mindset to develop business.

The distinctive feature of IEM at Aalto University is its focus on strategic and entrepreneurial leadership in business development, complementing the approaches of classical industrial engineering on developing processes and complex systems. This combination emphasizes the focus on the capability to solve the right problems right, i.e. identify needs, define problems accordingly, and solve them effectively. The IEM program provides a cross-disciplinary skill set consisting of mathematical, technological, economic, and social competences that focuses on proactive problem solving in value creating processes. In essence, the ethos of IEM studies emphasizes a systemic, solution oriented engineering mindset. Building on these foundations, the program develops strong competencies for the creation and transformation of technology-based business combining strategic, operations, and people perspectives.

The generic aims of the education are listed below.

- Provide students with in-depth knowledge of the field of the major and give them the knowledge and skills needed to understand the challenges of the field from the points of view of users, technical and social systems, and the environment.
- Provide students with the knowledge and skills needed for operating as an expert and developer of the field.
- Provide students with the knowledge and skills needed to apply scientific knowledge and scientific methods independently and, eventually, needed for scientific postgraduate education.
- Provide students with the language and communication skills needed to follow the scientific development of the field and to engage in scholarly communication in the field of science and technology.

The more detailed learning objectives concerning the field of major are described by each major and each course.

An expert and developer in the field of industrial engineering and management need to understand the engineering processes and the systems in order to be able to create and transform technology-based business. He or she should be able to follow and critically analyze development in a field of technology.

Skills and in-depth knowledge acquired in the field of the major combined with technical expertise acquired in the minor give graduates the knowledge and skills needed to understand the challenges of the field from the points of view of users, technical and social systems, and the environment.

The knowledge and skills needed to apply scientific knowledge and scientific methods independently are mainly acquired in the major studies. Combined with the master's thesis, the knowledge and skills needed for scientific postgraduate education are achieved. The research assignment preceding the master's thesis has an important role.

Majors

There are four majors in the Master's Programme in Industrial Engineering and Management:

- Leadership and Knowledge Management
- Operations and Service Management
- Strategy and Venturing
- Strategy

Leadership and Knowledge Management

Professor in charge: Matti Vartiainen

Extent: 45 ECTS credits

Code: SCI3048

The major in Leadership and Knowledge Management focuses upon people in technology-based work, and investigates leadership, collaboration and the human potential as critical success factors for creating and transforming technology-based organizations.

The mission of the major is to promote the role of people for the success of companies, public organizations and society at large. Research and teaching concentrates on the fundamental human factors that affect sustainable growth in technology-intensive environments. With particular emphasis on engineering and innovation, the center of interest is upon leadership and self-leadership, interaction, knowledge sharing, learning, collaboration, work design in digital knowledge work, wellbeing and attitudes of people in the context of work.

The students majoring in Leadership and Knowledge Management know how to lead and inspire people in technology-intensive environments. They learn skills and knowledge required to

- lead change in organizational context,
- enhance teamwork and collaboration,
- create and utilize knowledge in emerging forms of organizations.

They learn to understand human behaviour. They learn skills and knowledge required to

- analyse and utilize individual and organisational knowledge,
- evaluate and develop organizations and work practices,
- explore human potential and growth and create better collaboration in organizations and between them.

They learn to envision a better future. They understand

- how future organizations evolve,
- how an ethically better future for businesses and society can be built,
- the importance of self-leadership in building better life.

Courses

Code	Name	Credits	Period	Year
Compulsory courses 25 credits:				
TU-E3020	Knowledge Management in Practice	5	I-II	1. year
TU-E3010	Leading as Practice	5	III-IV	1. year
TU-E3031	Collaboration in Teams and Networks	5	I-II	1. year
TU-E3040	Human Potential	5	III-IV	1. year
TU-E3090	Research Assignment in Leadership and Knowledge Management	5	III-V, I-II	1. year or 2. year
Integrative courses in the field of the programme, 10 credits*:				
<i>Choose 5 credits from the course list of Strategy and Venturing:</i>			HOPS	
21E00034	Strategy Process	6	II	
TU-E1010	Advanced Strategic Management	5	I	
TU-E1021	Strategies for Growth and Renewal	5	III-IV	
TU-E1030	Advanced Case-Seminar in Strategy	5	I	
<i>Choose 5 credits from the course list of Operations and Service Management:</i>			HOPS	
TU-E2012	Service Operations Management	5	III-IV	

TU-E2020	Advanced Operations Management	5	II
TU-E2030	Advanced Project-based Management	5	I-II
TU-E2040	Management of External Resources	5	I

*) Consider prerequisites and possible quotas when selecting integrative courses.

Note: Only one Research Assignment is allowed in the major!

Optional courses

Choose **10 credits** from this list of optional courses.

Optional courses of majors

These courses are listed below thematically. Some courses overlap multiple themes and may appear more than once.

Code	Name	Credits	Period	Year
Entrepreneurship and Venturing				
TU-E4030	Entrepreneurial Finance	5	IV	1. year
TU-E4080	Managing Innovative Sales	3	II	1. year
TU-E4090	Managing Innovative Sales, exercises	3	II	1. year
TU-E1131	Financial Modeling in Strategy and Venturing	5	II	1.or 2.year
TU-E1140	Contracting in Strategy and Venturing	2	IV	1. year
TU-E2130	Operations Management for New Ventures	3-5	III-IV	1. year
TU-E4070	Entrepreneurial Marketing	5	V	1. year
Innovation				
TU-E1120	Strategic Management of Technology and Innovation	5	III-V	1. year
TU-E4040	Opportunity Prototyping	3	I	1. year
TU-E4060	Design & Innovation in Context	6	II	1. year
TU-E2110	Innovation in Operations and Services	3-5	III-IV	1. year
Finance & Financial Engineering				
TU-E2210	Financial Engineering I	3-5	I-II	1. year
TU-E2220	Financial Engineering II	3-6	III	1. year
TU-E4030	Entrepreneurial Finance	5	IV	1. year
TU-E1131	Financial Modeling in Strategy and Venturing	5	II	1.or 2. year
28E35100	Corporate Financial Management (limited for Strategy and Venturing major, max.10 students)	6	I	1. year
Leadership				
TU-E4050	Entrepreneurial Leadership	5	V	1. year

TU-E3110	Work Design in Organizations	5	III-IV	2.year
TU-E3121	People in Service Operations	5	II	1.year
TU-E3130	Luovan ongelmanratkaisun seminaari	5-8	I-II	1. or 2.year
TU-A1150	Filosofia ja systeemiajattelu**	3	III-IV	1.year
Operations				
TU-E2120	Project Business	3-5	III-IV	1.year
TU-E2130	Operations Management for New Ventures	3-5	III-IV	1.year
TU-E6110	Management for Network Business Processes	3-5	I-II	1.year
TU-E6120	Co-Development Interventions in Business Networks	5	III-IV	1.year
TU-E6140	Business Game	3	I, II, III, IV, V	1.year

**) if this course has been completed for Bachelor's degree, it cannot be included in major studies.

Operations and Service Management

Professor in charge: Kari Tanskanen

Extent: 45 credits

Code: SCI3049

Operations management covers issues from operations strategy to efficient execution of operations, i.e., from configuring appropriate resources and processes into a production system that best contributes the organization's goals and competitive advantage to managing the production system in order to provide the best match with demand and supply. The major in operations and service management builds on the generic principles on operations management but emphasizes the novel ways of encountering the challenges and utilizing the opportunities related to creating and transforming technology-based business.

Advanced production systems cross organizational borders and utilize external resource networks effectively in global scale. Business models have developed beyond the conventional manufacturing-focused forms into service systems and project or solution business. As technological, social or organisational innovations emerge, resources and processes in production systems should be vigorously re-configured for improved performance from customers', network partners' and society's perspective. Sustainability, effectiveness and efficiency are all important elements of performance. Consequently, the major in operations and service management focuses on operations strategy, management of operations in inter-organizational systems, as well as the life-cycle management of production systems and their offerings to clients. Industrial service systems, project business framework, and integration of digital technologies into operations are central contextual themes.

The students majoring in operations and service management attain comprehensive understanding of modern operations and service management practices and the underlying theories. They learn

- how to plan and control operations in multi-firm context
- how to configure and manage resources and processes in inter-organizational relationships
- how to analyse the performance of and the risks related to modern production systems through the relevant life cycle
- how to manage value in production systems according to the requirements of the dynamic business environments.

Courses

Code	Name	Credits	Period	Year
Compulsory courses 25–27 credits:				
TU-E2012	Service Operations Management	5	III-IV	1. year
TU-E2020	Advanced Operations Management	5	II	1. year
TU-E2030	Advanced Project-based Management	5	I-II	1. year
TU-E2040	Management of External Resources	5	I	1. year
TU-E2090	Research Assignment in Operations and Service Management	5-7	III-V, I-II	1. year OR 2. year
Integrative courses in the field of the programme, 10 credits *:				
<i>Choose 5 credits from the course list of Leadership and Knowledge Management:</i>				HOPS
TU-E3020	Knowledge Management in Practice	5	I-II	
TU-E3010	Leading as Practice	5	III-IV	
TU-E3031	Collaboration in Teams and Networks	5	I-II	
TU-E3040	Human Potential	5	III-IV	
<i>Choose 5 credits from the course list of Strategy and Venturing:</i>				HOPS
21E00034	Strategy Process	6	II	
TU-E1010	Advanced Strategic Management	5	I	

TU-E1021	Strategies for Growth and Renewal	5	III-IV
TU-E1030	Advanced Case-Seminar in Strategy	5	I

*) Consider pre-requisites and possible quotas when selecting integrative courses.

Note: Only one Research Assignment is allowed in the major!

Optional courses 8–10 credits

Choose 8–10 credits from the list of optional courses. These courses are listed below thematically. Some courses overlap multiple themes and may appear more than once.

Code	Name	Credits	Period	Year
Entrepreneurship and Venturing				
TU-E4030	Entrepreneurial Finance	5	IV	1. year
TU-E4080	Managing Innovative Sales	3	II	1. year
TU-E4090	Managing Innovative Sales, exercises	3	II	1. year
TU-E1131	Financial Modeling in Strategy and Venturing	5	II	1. or 2. year
TU-E1140	Contracting in Strategy and Venturing	2	IV	1. year
TU-E2130	Operations Management for New Ventures	3-5	III-IV	1. year
TU-E4070	Entrepreneurial Marketing	5	V	1. year
Innovation				
TU-E1120	Strategic Management of Technology and Innovation	5	III-V	1. year
TU-E4040	Opportunity Prototyping	3	I	1. year
TU-E4060	Design & Innovation in Context	6	II	1. year
TU-E2110	Innovation in Operations and Services	3-5	III-IV	1. year
Finance & Financial Engineering				
TU-E2210	Financial Engineering I	3-5	I-II	1. year
TU-E2220	Financial Engineering II	3-6	III	1. year
TU-E4030	Entrepreneurial Finance	5	IV	1. year
TU-E1131	Financial Modeling in Strategy and Venturing	5	II	1. or 2. year
28E35100	Corporate Financial Management (limited for Strategy and Venturing major, max.10 students)	6	I	1. year
Leadership				
TU-E4050	Entrepreneurial Leadership	5	V	1. year
TU-E3110	Work Design in Organizations	5	III-IV	2. year
TU-E3121	People in Service Operations	5	II	1. year
TU-E3130	Luovan ongelmanratkaisun seminaari	5-8	I-II	1. or 2. year

TU-A1150	Filosofia ja systeemiajattelu*	3	III-IV	1.year
Operations				
TU-E2120	Project Business	3-5	III-IV	1.year
TU-E2130	Operations Management for New Ventures	3-5	III-IV	1.year
TU-E6110	Management for Network Business Processes	3-5	I-II	1.year
TU-E6120	Co-Development Interventions in Business Networks	5	III-IV	1.year
TU-E6140	Business Game	3	I, II, III, IV, V	1.year

*) if this course has been completed for Bachelor's degree, it cannot be included in major studies.

Framtidens Industriföretag (FIF)

FIF is a Nordic interdisciplinary programme for engineering students. Students of Industrial Engineering and Management can apply to part in FIF. The application round is organized annually in March/April.

FIF programme is especially compatible with Operations and Service Management major. Course choices for the FIF programme are confirmed in the student's personal study plan after consultation with the professor. FIF courses can be included in major and/or minor, and elective studies. For more information on FIF, please see fif.aalto.fi.

Strategy and Venturing

Professor in charge: Markku Maula

Extent: 45 credits

Code: SCI3050

The major in Strategy and Venturing in the IEM program develops leaders and experts in strategic management and new business development capable of leading and transforming existing business and building new business. The understanding of and skills in strategic management and venturing are complemented with understanding of operations and people skills and studies in the context of technology-based business.

The primary learning objectives of the Strategy and Venturing major are:

- Capabilities to lead and organize strategy work to improve value creation
- Capabilities to analyze sources of competitive advantage in technology based-business
- Capabilities to build and renew technology-based business in new and established organizations.

In addition to these primary learning objectives, studying Strategy and Venturing in the IEM program gives our graduates significant strengths including an integrative understanding of technology and business, a combination of theoretical understanding and a pragmatic can-do attitude, analytical capabilities to solve complex real life problems using data, people skills to build and lead organizations, diverse knowledge and experience from startups to largest corporations, and a global orientation and ambition level.

Courses

Code	Name	Credits	Period	year
Compulsory courses 26 credits				
21E00034	Strategy Process	6	II	1.year
TU-E1010	Advanced Strategic Management	5	I	1. year
TU-E1021	Strategies for Growth and Renewal	5	III-IV	1.year
TU-E1030	Advanced Case-Seminar in Strategy	5	I	2.year
TU-E1090	Research Assignment in Strategy and Venturing	5	III-IV or I-II	1.year or 2.year
Integrative courses in the field of the programme, 10 credits*:				
<i>Choose 5 credits from the course list of Operations and Service Management:</i>				HOPS
TU-E2012	Service Operations Management	5	III-IV	
TU-E2020	Advanced Operations Management	5	II	
TU-E2030	Advanced Project-based Management	5	I-II	
TU-E2040	Management of External Resources	5	I	
<i>Choose 5 credits from the course list of Leadership and Knowledge Management:</i>				HOPS
TU-E3020	Knowledge Management in Practice	5	I-II	
TU-E3010	Leading as Practice	5	III-IV	
TU-E3031	Collaboration in Teams and Networks	5	I-II	
TU-E3040	Human Potential	5	III-IV	

*) Consider prerequisites and possible quotas when selecting integrative courses.

Note: Only one Research Assignment is allowed in the major.

Optional courses 9 credits

Choose 9 credits from the following group of optional courses.

Entrepreneurship & Venturing
Innovation
Finance & Financial Engineering

These courses are listed below thematically. Some courses overlap multiple themes and may appear more than once.

Code	Name	Credits	Period	Year
Entrepreneurship and Venturing				
TU-E4030	Entrepreneurial Finance	5	IV	1. year
TU-E4080	Managing Innovative Sales	3	II	1. year
TU-E4090	Managing Innovative Sales, exercises	3	II	1. year
TU-E1131	Financial Modeling in Strategy and Venturing	5	II	1.or 2.year
TU-E1140	Contracting in Strategy and Venturing	2	IV	1. year
TU-E2130	Operations Management for New Ventures	3-5	III-IV	1. year
TU-E4070	Entrepreneurial Marketing	5	V	1. year
Innovation				
TU-E1120	Strategic Management of Technology and Innovation	5	III-V	1. year
TU-E4040	Opportunity Prototyping	3	I	1. year
TU-E4060	Design & Innovation in Context	6	II	1. year
TU-E2110	Innovation in Operations and Services	3-5	III-IV	1. year
Finance & Financial Engineering				
TU-E2210	Financial Engineering I	3-5	I-II	1. year
TU-E2220	Financial Engineering II	3-6	III	1. year
TU-E4030	Entrepreneurial Finance	5	IV	1. year
TU-E1131	Financial Modeling in Strategy and Venturing	5	II	1.or 2.year
28E35100	Corporate Financial Management (limited for Strategy and Venturing major, max.10 students)	6	I	1. year
Leadership				
TU-E4050	Entrepreneurial Leadership	5	V	1. year
TU-E3110	Work Design in Organizations	5	III-IV	2. year
TU-E3121	People in Service Operations	5	II	1. year
TU-E3130	Luovan ongelmanratkaisun seminaari	5-8	I-II	1. or 2. year
TU-A1150	Filosofia ja systeemiajattelu	3	III-IV	1. year
	If this course has been completed for Bachelor's degree, it cannot be included in major studies.			

Operations

TU-E2120	Project Business	3-5	III-IV	1.year
TU-E2130	Operations Management for New Ventures	3-5	III-IV	1.year
TU-E6110	Management for Network Business Processes	3-5	I-II	1.year
TU-E6120	Co-Development Interventions in Business Networks	5	III-IV	1.year
TU-E6140	Business Game	3	I, II, III, IV, V	1.year

Strategy

Professor in charge: Timo Vuori

Extent: 45 credits

Code: SCI3051

The Strategy specialization in Industrial Engineering and Management is closely aligned with and organized in collaboration with the Master's Programme in Strategy at the Aalto School of Business and indeed used to be a jointly-organized stand-alone Master's programme also at the School of Science. The ongoing role of this program is to combine the strengths of both schools in strategy and organization in a joint program.

The goal of the Strategy major is to train and develop experts in the domain of business development in new organizations, established firms, and multinational corporations, apt to thrive and succeed in today's constantly changing and increasingly complex business environment. In addition to analytical skills and knowledge of key ideas in business and organizations, the major is also designed to develop participants' intercultural and interpersonal sensitivities, behaviors, attitudes as well as international connections and networks.

The learning objectives are divided into four key domains:

1. Core strategy skills

- Ability to analyze and extract insights from information
- Ability to craft and evaluate strategic initiatives

2. People & leadership

- Leading and facilitating organizational changes
- Ability to understand and participate in strategy processes

3. Organization and capabilities

- Organizational design and structures
- Organizing and strategy in multinational firms

4. Business environment, competition, and markets

- Analysis of industries and business ecosystems
- Competitor analysis and marketing strategy.

Courses

Code	Name	Credits	Period	Year
Compulsory courses 39 credits:				
Courses offered by School of Science:				
TU-E1010	Advanced Strategic Management	5	I	1. year
TU-E1030	Advanced Case-Seminar in Strategy	5	I	2. year
TU-E1090	Research Assignment in Strategy and Venturing	5	III-V, I-II	1. year or 2. year
Courses offered by School of Business:				
21E00034	Strategy Process	6	II	1.year
21E00030	Strategy Work	6	II	1.year
28E35100	Corporate Financial Management	6	I	1.year
21E00052	Data-driven Business	6	III	1. year

Optional courses 6 credits, choose from the lists below.

Courses offered by School of Science

These courses are listed thematically. Some courses overlap multiple themes and may appear more than once.

Code	Name	Credits	Period	Year
Entrepreneurship and Venturing				
TU-E4030	Entrepreneurial Finance	5	IV	1. year
TU-E4080	Managing Innovative Sales	3	II	1. year
TU-E4090	Managing Innovative Sales, exercises	3	II	1. year
TU-E1131	Financial Modeling in Strategy and Venturing	5	II	1.or 2.year
TU-E1140	Contracting in Strategy and Venturing	2	IV	1. year
TU-E2130	Operations Management for New Ventures	3-5	III-IV	1. year
TU-E4070	Entrepreneurial Marketing	5	V	1. year
Innovation				
TU-E1120	Strategic Management of Technology and Innovation	5	III-V	1. year
TU-E4040	Opportunity Prototyping	3	I	1. year
TU-E4060	Design & Innovation in Context	6	II	1. year
TU-E2110	Innovation in Operations and Services	3-5	III-IV	1. year
Finance & Financial Engineering				
TU-E2210	Financial Engineering I	3-5	I-II	1. year
TU-E2220	Financial Engineering II	3-6	III	1. year
TU-E4030	Entrepreneurial Finance	5	IV	1. year
TU-E1131	Financial Modeling in Strategy and Venturing	5	II	1.or 2. year
28E35100	Corporate Financial Management (limited for Strategy and Venturing major, max.10 students)	6	I	1. year
Leadership				
TU-E4050	Entrepreneurial Leadership	5	V	1. year
TU-E3110	Work Design in Organizations	5	III-IV	2. year
TU-E3121	People in Service Operations	5	II	1. year
TU-E3130	Luovan ongelmanratkaisun seminaari	5-8	I-II	1. or 2. year
TU-A1150	Filosofia ja systeemiajattelu If this course has been completed for Bachelor's degree, it cannot be included in major studies.	3	III-IV	1. year
Operations				
TU-E2120	Project Business	3-5	III-IV	1. year
TU-E2130	Operations Management for New Ventures	3-5	III-IV	1. year
TU-E6110	Management for Network Business Processes	3-5	I-II	1. year

TU-E6120	Co-Development Interventions in Business Networks	5	III-IV	1.year
TU-E6140	Business Game	3	I, II, III, IV, V	1.year

Courses offered by School of Business

Code	Name	Credits	Period
23E21050	Marketing, Strategy and Firm Performance	6	I, V
OR			
23E21090	Markkinastrategia ja kilpailuosaaminen	6	I
21E00029	Managing Mergers and Acquisitions	6	V
21E00031	Innovation, Strategic Resilience and Renewal	6	IV
21E01050	Management and Strategy Making, book exam	6	I, II, V
21E00051	Strategic Human Resource Management	6	II
21E00902	Project Work*	6	
22E00100	Financial Statement Analysis	6	I, IV
23E10000	Service Business Strategy	6	III
23E87050	Meet the Stage: Public Speaking and Interaction Skills	6	II, III
51E00100	Business Ethics	6	IV
71E00200	Communication in Strategy Work	6	II
75E24000	Business Presentations	3	III, V
OR			
75E25000	Business Negotiations	3	IV, V

*) must be approved in advance by professor in charge of major.

Minor

The expertise of an industrial engineer is contingent on the understanding of opportunities provided and constraints imposed by technical systems. An expert in the field of industrial engineering and management needs to understand the engineering processes and systems in order to be able to create and transform technology-based business. This requires expertise in a selected field of engineering, so that a graduate from the programme has the knowledge and skills to follow and critically analyze development in this field. The foundation for this engineering knowledge is created in Bachelor's studies and refined at the Master's level.

To acquire appropriate level of knowledge in a technical discipline, the student can choose the minor from an appropriate field of engineering. The selection of the minor is regulated, and suitable options depend on the educational background of the student.

Students with Bachelor's degree in Industrial Engineering and Management, and all other students with equivalent educational background: Students with BSc in IEM or equivalent studies are required to choose the minor of their master's studies in a field of engineering that clearly differs from industrial engineering and management. The minor may be in a different field of engineering than the minor of their bachelor's degree. The minor should be selected from the offering by Aalto schools of technology. However, the programme may disallow some minors because of overlap with industrial engineering and management. For the same reason, the programme may also restrict the choice of optional courses within a minor.

The educational background is assessed during the admission process. Graduates from **the Bachelor's Programme in Science and Technology (Teknistieteellinen kandidaattiohjelma) majoring in industrial engineering and management follow these guidelines.**

Students with a Bachelor's degree with the major in a field of engineering that clearly differs from industrial engineering and management: The minor can be chosen freely. Again, the educational background is assessed during the admission process.

Students with a Bachelor's degree in other fields: Students with bachelor's degree in non-engineering fields such as natural sciences choose the minor of their master's studies in a field of engineering that clearly differs from industrial engineering and management. The minor should be selected from the offering by Aalto schools of technology. However, the programme may disallow some minors because of overlap with industrial engineering and management. For the same reason, the programme may also restrict the choice of optional courses within a minor.

Any student may also include a second minor in the elective studies. The programme has no restrictions concerning the second minor.

In every case, the minor may be of master's level or bachelor's level. The minor is confirmed in the Personal Study Plan.

Students whose choice of minor is restricted, select their minor from those offered by Aalto schools of technology: School of Chemical Technology (CHEM), School of Electrical Engineering (ELEC), School of Engineering (ENG) or School of Science (SCI).

Student Mobility at Aalto: [Minors 2017-2018](#)

When your choice of minor is restricted, please note the following general principles:

- The objectives and content of the minor must be clearly from a field of technology other than IEM.
- Some minors contain courses that are offered by the Department of Industrial Engineering and Management (course code format being TU-9XXX) or the School of Business (99X99999). Replace these courses with other courses accepted in the minor. Examples of such cases include:
 - SCI3077 Systems and Operations Research (the course MS-C2197= TU-A1150 is not allowed)
- Due to the above-mentioned general principles, the following minors are disallowed:
 - **The Aalto University joint minors**, i.e. Aaltonaut, CHEMARTS, Startup Minor/Aalto Ventures Program Minor, Aalto Service Minor, Creative Sustainability, International Design Business Management, USchool and Multi-Disciplinary Energy Studies. ~~The only exception is SCI3073 Analytics and Data Science. It is allowed but the student must not include courses that are offered by the Department of Industrial Engineering and Management (course code format being TU-9XXX) or the School of Business (99X99999).~~
 - SCI3086 Financial Engineering
 - ENG3067 ME310 Aalto-Global Innovation Program
 - Bachelor-level minors: ENG3065 Kiinteistötalous (Real Estate Economics), ENG3070 Vesi- ja ympäristötekniikka (Water and Environmental Engineering), CHEM3018 Luonnonvarojen kestävä jalostaminen (Sustainable processing of natural resources), ENG3047 Built Environment (Rakennettu ympäristö), SCI3030 Informaatioverkostot (Information Networks), and SCI3063 Tilastotiede (Statistics).

A minor designed for the bachelor's level may be included in the master's degree. Many of the bachelor-level minors are offered in Finnish, which may in practice limit the choices of foreign students. Problems may also arise if the student does not have sufficient prerequisite knowledge for a master-level minor, and the prerequisite course is offered in Finnish. To avoid these problems, the following minors are recommended:

- ENG3048 Computation and Modelling in Engineering
- SCI3070 Machine Learning and Data Mining
- SCI3067 Human Neuroscience and Technology
- SCI3077 Systems and Operations Research

Elective studies

Students choose 25 ECTS of elective studies. As elective studies, students can complete a minor and/or take individual courses from other programmes at Aalto University or other Finnish universities. Students can also participate in an international student exchange programme or include 1–10 ECTS of work experience completed in Finland or abroad in elective studies.

For more information on internationalisation or Aalto University's minor subjects:

- [Elective studies](#)
- [Internationalisation and studies abroad](#)

Language studies

Compulsory language studies for students whose language of education is Finnish or Swedish are included as part of the bachelor's degree. If the language studies have not been completed in the phase preceding master's studies, they must be taken during the master's degree studies. In this case, the student must take 2 ECTS in second national language and 3 ECTS in one foreign language (including both oral (o) and written (w) proficiency).

Students who have received their education in a language other than Finnish or Swedish or received their education abroad are required to complete only 3 ECTS in one foreign language.

Students with excellent command of English (e.g. English as a first language) may apply for the exemption from the compulsory foreign language requirement and take 3 ECTS of Finnish courses instead. In this case, according to the Degree Regulations, the student has not demonstrated the requisite written and oral language requirement in a foreign language, which is reflected in the appendix of the degree certificate. Students may apply for an exemption in the beginning of each term (deadlines 15 September and 15 January) with an application form available in Into at <https://into.aalto.fi/display/eniem/Exemptions+from+language+requirements>

Language studies are included in students' elective studies.

Master's thesis

Students are required to complete a master's thesis, which is a research assignment with a workload corresponding to 30 ECTS. The thesis is written on a topic related to the major, and is agreed upon with a professor who specializes in the topic of the thesis.

Professors of IEM are listed on the department's website: <http://tuta.aalto.fi/en/research/professors/>.

Any alterations in supervision or topic area of the theses is at the discretion of the responsible professor of the major. The supervisor of the thesis must be a professor in the University, whereas the thesis advisor(s) can also be from a company or from another university. Thesis advisor(s) must have at least a master's degree.

Master's thesis work includes a seminar presentation or equivalent presentation. The student is also required to write a maturity essay related to the master's thesis.

The master's thesis is a public document. No part of the thesis can be undisclosed.

For more information about master's thesis process, please see: <https://mycourses.aalto.fi/course/view.php?id=19277>