Programme syllabus

Master's Programme, Engineering Design, 120 credits
Masterprogram, industriell produktutveckling
120.0 credits

Valid for students admitted to the education from autumn 14 (HT - Autumn term; VT - Spring term).

This is a translation of the Swedish, legally binding, programme syllabus.

Programme objectives

Those who graduate from the Industrial Product Development programme (Engineering Design) should be able to:

Knowledge and understanding

- demonstrate knowledge of product development and engineering design, with both scientific foundation and proven experience;
- have a good understanding of current research and development, and industrial development trends;
- have a good understanding of the processes, methods and tools required to develop technical products;
- have good working knowledge of technical systems composed of mechanical and mechatronic components;
- have good knowledge of the interactive features of technology products, and the different interactions between technical systems, people and the surrounding environment;
- have good knowledge of techniques to be able to develop ecologically and economically sustainable products;
- have a good foundation in the natural and engineering sciences, with a specialization in mechanical engineering, mechatronics or internal combustion engineering at an advanced level.

Skills and abilities

- demonstrate the ability to carry out innovative and professional product development;
• be able to integrate knowledge holistically, and demonstrate the ability to critically and independently define and creatively identify, formulate and deal with complex phenomena, issues and situations;
• demonstrate the ability to create technical solutions that meet human and societal needs;
• be able to critically, independently and creatively plan and create (with adequate methods and tools) relevant products, processes and systems in a timely manner, thereby contributing to the development of knowledge and evaluation of the project concerned;
• be able to critically and systematically integrate knowledge, and show the ability to define, model, simulate, predict and evaluate behaviour and performance of heterogeneous technical systems even when faced with limited or significant elements of irrelevant information;
• take responsibility for, and demonstrate the ability to actively contribute to, effective teamwork in different types of collaborative groups;
• be able to clearly present and discuss, both orally and in writing, their conclusions and the knowledge and arguments behind them, in dialogue with different groups in a national as well as in an international context;
• demonstrate the skills required to participate in research and development work, or to work independently in other advanced technology activities.

**Ability to make judgements and adopt a standpoint**

• demonstrate an awareness of the ethical aspects of research and development, and be able to make judgments with regard to relevant scientific, social and ethical aspects;
• demonstrate insight into the possibilities and limitations of engineering, its role in society and the responsibility for its use, including social and economic aspects, environmental and working-environment aspects;
• show a specific broad and deep understanding of the inherent complexity of technical systems, and be able to work with the subsequent understanding that the process of developing technical systems is often ill-defined with conflicting requirements and preferences;
• be aware of, and demonstrate a sense of, the responsibilities and ethical considerations that must be made in technical product development;
• show an aptitude for identifying the need for further knowledge, and to continuously upgrade their skills.

KTH’s local degree ordinance can be found in the KTH Regulations at: www.kth.se

**Extent and content of the programme**

The program comprises of 120 credits, equivalent to two years of study. The education is mainly at the advanced level and commences once a year.

The Track options for *Industrial Product Development (Engineering Design)* are:

- Internal Combustion Engines
- Machine Design
- Mechatronics

The programme is taught in English.
Eligibility and selection

To be eligible for this Masters program candidates require a relevant education, preferably in Mechanical Engineering, equivalent to at least 180 credits, a Bachelor of Science degree or another recognised technical degree.

Similar engineering or science education at an undergraduate level can also be considered as an entry requirement, provided that the relevant courses in mechanical engineering and product development have been completed. Other studies or work experience are assessed based on the real skills and competencies acquired. For KTH English language masters programmes, there is a specific requirement for English B or equivalent.

The selection procedure for the program is based on an evaluation of the following criteria: university / college, grades, courses relevant to the application, the covering letter, work experience and references.

In general, please refer to the KTH admissions procedure as stated in the KTH rules, www.kth.se.

Implementation of the education

Structure of the education

The programme structure is designed to provide opportunities both for students taking the 5-year Civilengineers degree (programmes Design and Product Realization, Mechanical Engineering and Vehicle Engineering), and / or for those wishing to take a 2-year Masters degree in Engineering Design.

Approach

The Academic year, semesters and study periods are described in the KTH Regulations at: www.kth.se.

The overall programme provides a common training package, which is both good preparation for engineering research and also provides a solid core for the three tracks – Internal Combustion Engines, Machine Design and Mechatronics.

The program ends with a thesis, 30 credits at advanced level, during the fourth semester.

Courses

The programme is course-based. Lists of courses are included in appendix 1.

Grading system

Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for courses under certain circumstances.

Conditions for participation in the programme
In order for a student to advance to the second academic year of the programme, they must have completed at least 45 credits during the first academic year (up until the last re-examination period before the second academic year begins). Students who do not meet this requirement should arrange to meet with the counsellor at the ITM School Education Office to establish an individual study plan.

Course enrolment

Registration to all courses within the programme should be made during the preceeding semester, in accordance with the KTH central guidelines.

Choice of Track

The choice of Track within the programme should be specified in the covering letter accompanying each student’s application. Applicants should be aware that each Track may have core courses that require prerequisite knowledge, which may involve adaptation courses (see Appendix 1).

Recognition of previous academic studies

Students have the possibility to apply for recognition of previous academic studies from course(s) at another higher education institution or university, both national and international.

KTH’s entire policy for recognition of previous academic studies can be found in KTH’s guidelines, www.kth.se

Studies abroad

With the examiner’s approval, the work for the final thesis report can be performed abroad.

It is also possible to study abroad for single semesters at universities that offer similar courses.

Degree project

The degree project consists of 30 higher education credits on the second level.

A student must have completed at least 60 higher education credits, including obligatory courses for the chosen master’s programme, before he/she can start his/her degree project.

The degree project work is graded according the seven-level grading system, A-F.

KTH’s rules for the degree project for Master’s degrees with tracks can be found in KTH’s guidelines, www.kth.se

Degree

In order to earn Degree of Master of Science (Two Years), passing grades in all courses which are included in the student’s study plan are required. The study plan must comprise 120 higher education credits which include a degree project consisting of 30 higher education credits, on the second level.
The student must apply for the degree and show his/her Bachelor Degree (or corresponding).

KTH’s local degree ordinance can be found at http://intra.kth.se/regelverk/

Appendix 1 - Course list
Appendix 2 - Programme syllabus descriptions
Appendix 1: Course list

Master's Programme, Engineering Design, 120 credits (TIPUM), Programme syllabus for studies starting in autumn 2014

Track, Combustion Engineering (IPUA)

Year 1

Mandatory courses (21.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF2030</td>
<td>Mechatronics basic Course</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MF2047</td>
<td>Internal Combustion Engines 1</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MF2070</td>
<td>Introduction to Engineering Design</td>
<td>3.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2125</td>
<td>Signals and Mechanical Systems</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

Conditionally elective courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK2036</td>
<td>Theory and Methodology of Science with Applications (Natural and Technological Science)</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EJ1234</td>
<td>Hybrid Vehicle Drives</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EL1000</td>
<td>Automatic Control, General Course</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>EL1120</td>
<td>Automatic Control, General Course</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>EL1820</td>
<td>Modelling of Dynamical Systems</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KE2050</td>
<td>Environmental Catalysis</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ME2063</td>
<td>Team Leadership and Human Resource Management</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MF1025</td>
<td>Model Based Product Development II</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MF1016</td>
<td>Model Based Product Development I</td>
<td>9.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MF2070</td>
<td>Dynamics and Motion Control</td>
<td>9.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MF2010</td>
<td>Component Design</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MF2018</td>
<td>Tribology</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MF2019</td>
<td>CAD 3D-modelling and Visualization</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>
MF2042  Embedded Systems for Mechatronics, I  6.0 hp  Second cycle
MF2043  Robust Mechatronics  6.0 hp  Second cycle
MF2044  Embedded Systems for Mechatronics, II  6.0 hp  Second cycle
MF2071  Research Methodology in Mechatronics  4.5 hp  Second cycle
MJ1401  Heat Transfer  6.0 hp  First cycle
MJ2429  Turbomachinery  6.0 hp  Second cycle
MJ2430  Thermal Turbomachinery  6.0 hp  Second cycle
SD2222  Vehicle Components  8.0 hp  Second cycle
SD2224  Vehicle Systems for a Better Environment  8.0 hp  Second cycle
SD2225  Ground Vehicle Dynamics, Basic Course  11.0 hp  Second cycle
SG1217  Fluid Mechanics, Basic Course  6.0 hp  First cycle
SG2212  Computational Fluid Dynamics  7.5 hp  Second cycle
SG2214  Fluid Mechanics  7.5 hp  Second cycle
SG2215  Compressible Flow  7.5 hp  Second cycle
SG2218  Turbulence  7.5 hp  Second cycle
SG2219  Advanced Compressible Flows  7.5 hp  Second cycle

Supplementary information

One of the following courses must be chosen: AK2036 or MF2071 and MF2072. MF2071 and MF2072 can be chosen during year 2.

The sum of conditionally elective courses must be at least 20 credits.

Year 2

Mandatory courses (30.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF205X</td>
<td>Degree Project in Internal Combustion Engineering, Second Cycle</td>
<td>30.0 hp  Second cycle</td>
</tr>
</tbody>
</table>

Conditionally elective courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK2030</td>
<td>Theory and Methodology of Science (Natural and Technological Science)</td>
<td>4.5 hp  Second cycle</td>
</tr>
<tr>
<td>AK2036</td>
<td>Theory and Methodology of Science with Applications (Natural and Technological Science)</td>
<td>7.5 hp  Second cycle</td>
</tr>
<tr>
<td>MF2066</td>
<td>Internal Combustion Engines Advanced Course</td>
<td>18.0 hp  Second cycle</td>
</tr>
<tr>
<td>MF2071</td>
<td>Research Methodology in Mechatronics</td>
<td>4.5 hp  Second cycle</td>
</tr>
</tbody>
</table>
Programme syllabus for Master's Programme, Engineering Design, 120 credits batch autumn 14.

**Supplementary information**

One of the following courses must be chosen:
AK2036 Theory and Methodology of Science with Applications (Natural and Technological Science) 7.5 credits (can be chosen in any period)
AK2030 Theory and Methodology of Science (Natural and Technological Science) 4.5 credits
MF2071 Research Methodology in Mechatronics 4.5 credits
MF2072 Research Methodology in Machine Design 6.0 credits

(MF2071 and MF2072 can be chosen during year 2.)

One of the following courses must be chosen:
MF2066 Internal Combustion Engines Advanced Course 18.0 credits
MF2075 Engineering Design Research Project 18.0 credits

Attn: Study year information concerning grading system

According to the President of the University’s decision on July 1, 2015, grades Pass (P) and Fail (F) will be used for the Master thesis. Students who have begun studies on July 1, 2007, and through June 30, 2015, also have the option to use the grading scale of A-F, for their Master thesis. Registration must be done before the course registration and before the thesis work starts.

**Track, Machine Design (IPUB)**

**Year 1**

**Mandatory courses (66.0 Credits)**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF2004</td>
<td>Advanced Machine Design</td>
<td>18.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2006</td>
<td>Innovative Design II</td>
<td>6.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2010</td>
<td>Component Design</td>
<td>6.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2011</td>
<td>Systems Engineering</td>
<td>9.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2018</td>
<td>Tribology</td>
<td>6.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2024</td>
<td>Robust and Probabilistic Design</td>
<td>6.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2031</td>
<td>Advanced Prototyping</td>
<td>6.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2067</td>
<td>Hydraulics I</td>
<td>6.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2070</td>
<td>Introduction to Engineering Design</td>
<td>3.0 hp Second cycle</td>
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</table>

**Supplementary information**
Year 2

Mandatory courses (60.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits Edu. level</th>
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</thead>
<tbody>
<tr>
<td>MF2004</td>
<td>Advanced Machine Design</td>
<td>18.0 hp Second cycle</td>
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<tr>
<td>MF2030</td>
<td>Mechatronics basic Course</td>
<td>6.0 hp Second cycle</td>
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<tr>
<td>MF206X</td>
<td>Degree Project in Machine Design, Second Cycle</td>
<td>30.0 hp Second cycle</td>
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<tr>
<td>MF2072</td>
<td>Research Methodology in Machine Design</td>
<td>6.0 hp Second cycle</td>
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</table>

Supplementary information

MF2004 Advanced Machine Design 18 credits,
6 credits Spring 2015 / 18 credits Autumn 2015

Attn: Study year information concerning grading system

According to the President of the University’s decision on July 1,2015, grades pass (P) and fail (F) will be used for the Master thesis. Students who have begun studies on July 1,2007, and through June 30,2015, also have the option to use the grading scale of A-F, for their Master thesis. Registration must be done before the course registration and before the thesis work starts.

Track, Mechatronics (IPUC)

Year 1

Mandatory courses (45.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits Edu. level</th>
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<tbody>
<tr>
<td>MF2007</td>
<td>Dynamics and Motion Control</td>
<td>9.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2030</td>
<td>Mechatronics basic Course</td>
<td>6.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2042</td>
<td>Embedded Systems for Mechatronics, I</td>
<td>6.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2043</td>
<td>Robust Mechatronics</td>
<td>6.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2044</td>
<td>Embedded Systems for Mechatronics, II</td>
<td>6.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2058</td>
<td>Mechatronics, Advanced Course Spring Semester</td>
<td>9.0 hp Second cycle</td>
</tr>
<tr>
<td>MF2070</td>
<td>Introduction to Engineering Design</td>
<td>3.0 hp Second cycle</td>
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Year 2

Mandatory courses (34.5 Credits)
### Programme syllabus for Master's Programme, Engineering Design, 120 credits batch autumn 14.

#### Conditionally elective courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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<tbody>
<tr>
<td>MF204X</td>
<td>Degree Project in Mechatronics, Second Cycle</td>
<td>30.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MF2071</td>
<td>Research Methodology in Mechatronics</td>
<td>4.5 hp</td>
<td>Second cycle</td>
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</table>

#### Conditionally elective courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
</table>
| MF2059      | Mechatronics, Advanced Course, Fall semester  
One of the courses MF2059 and MF2075 must be chosen                                                                                           | 15.0 hp | Second cycle |
| MF2075      | Engineering Design Research Project  
One of the courses MF2075 and MF2059 must be chosen                                                                                           | 18.0 hp | Second cycle |

### Supplementary information

**One of the courses must be chosen**

MF2059 Mechatronics, Advanced Course, Fall semester 15.0 credits  
MF2075 Engineering Design Research Project 18.0 credits

**Attn: Study year information concerning grading system**

According to the President of the University’s decision on July 1, 2015, grades pass (P) and fail (F) will be used for the Master thesis. Students who have begun studies on July 1, 2007, and through June 30, 2015, also have the option to use the grading scale of A-F, for their Master thesis. Registration must be done before the course registration and before the thesis work starts.
Appendix 2: Specialisations

Master's Programme, Engineering Design, 120 credits (TIPUM), Programme syllabus for studies starting in autumn 2014

Track, Combustion Engineering (IPUA)
Track, Machine Design (IPUB)
Track, Mechatronics (IPUC)