Programme syllabus

Degree Programme in Materials Design and Engineering
Civilingenjörsutbildning i materialdesign

300.0 credits

Valid for students admitted to the education from autumn 19 (HT - Autumn term; VT - Spring term).

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

Programme objectives

In addition to the objectives specified in the Swedish Higher Education Ordinance, a graduate Master of Science in Engineering from the Degree Programme in Materials Design and Engineering at KTH shall have the following knowledge, skills and abilities of judgment…

Knowledge and understanding

- Possess broad knowledge of Materials Design and Engineering in order to develop and manufacture new materials based on metals, ceramics, polymers and fibre materials

- Have in-depth knowledge within the field of materials science and of the relationship between the production, structure, properties and use of materials. The scientific perspective should be able to include all scales of lengths, from the nanometre level across the micrometre level to the component level in the finished product.

Skills and abilities

- Possess experimental skills trained in material synthesis and material analysis, as well as analytical skill and systems thinking trained in material selection and the design of new materials and processes

- Employ a holistic perspective to material selection and the development and use of materials based on an industrial ecological approach. This involves a systems approach where functionality, performance, reliability and economy are interwoven with aspects of sustainability such as environmental impact, ecocycle adaptation and availability

- Possess the requisite personal and professional skills, such as in the area of language, leadership, project management and communication, to work as an engineer in a management position or as a leader within a technology-intensive company
**Ability to make judgements and adopt a standpoint**

- Have a good understanding of the fact that engineering problems, viewed from a systems perspective, are often complex, can be incompletely defined and sometimes involve conflicting conditions

- Employ a reflective approach to accountability and ethical issues within technical, organisational, economic, ecological and societal systems

**Extent and content of the programme**

The Degree Programme in Materials Design and Engineering comprises 300 higher education credits, which corresponds to 5 years of full-time studies at a normal study pace (10 semesters).

The programme's first three years (180 credits) are primarily first cycle.

During the two final years (120 credits), the student undertakes a Master's programme. Master's programme courses are conducted primarily in the second cycle.

The academic year 2019/2020 offers the following Master's programmes that lead to a Degree of Master of Science in Materials Design and Engineering:

- **Sustainable Energy Engineering**
- **Industrial Engineering and Management**
- **Production Engineering and Management**
- **Nuclear Energy Engineering**
- **Macromolecular Materials**
- **Naval Architecture (the track Lightweight Structures)**
- **Nanotechnology**
- **Engineering Mechanics (track Solid Mechanics)**
- **Engineering Materials Science (track Industrial Materials)**

The range of offered Master's programmes may be revised. An updated list of elective Master's programmes can be found on the KTH student web for each respective academic year.

**Language of instruction**

The language of instruction for the first three years of first cycle is mainly Swedish, but the language of instruction in the second cycle for the final two years is mostly English.

**Eligibility and selection**

Admission to the Degree Programme in Materials Design and Engineering requires the general entry requirements for higher education, and also special admission requirements as follows:

*Upper-secondary education before 1 July 2011 and upper-secondary adult education before 1 July 2012*

Field-specific entry requirement 9
Specific admission requirements corresponding to:

Mathematics E, Physics B and Chemistry A.
In each of the subjects, a minimum grade of Pass or 3 is required.

Upper-secondary education from 1 July 2011 and upper-secondary adult education from 1 July 2012 (Gy11/Vux12)

Field-specific entry requirement A9

Specific admission requirements corresponding to:

Mathematics 4, Physics 2 and Chemistry 1.
A grade of E is required as a minimum in each of the subjects.

* For more information on field-specific entry requirements, see www.uka.se
Otherwise refer to the KTH admission regulations in the KTH regulatory framework. www.kth.se

Implementation of the education

Structure of the education

Academic year:
The academic year comprises 40 weeks and is divided into four periods. If necessary, instruction may be provided outside the periods.

The division of the academic year is presented on the KTH student web www.kth.se

Years 1-3, studies at first cycle

The programme syllabus consists of the compulsory foundation block in the years 1-3 in the first cycle (G), and also of a Master's programme in the second cycle (A), years 4-5, which concludes with a degree project of 30 credits.

The programme is organised around courses in applied subjects relating to mathematics, engineering science and technology. The teaching and use of professional skills and abilities of great importance to a certified engineer, including communication, ethics, entrepreneurship, sustainable development, corporate and societal aspects, are integrated into the courses.

To create a unified whole, the programme emphasises cooperation between different subjects, both within a specific year and between years. This is achieved through courses being coordinated on the schedule, via joint degree projects and written assignments etc.

The education in years 1 and 2 and parts of year 3 are common for all students on the programme. Prior to the concluding stage of the education, the student chooses a Master's programme. Within the chosen Master's programme, a specialised applied area within the materials design and engineering field is studied.
The programme is designed so that the student, after three years, has the opportunity to obtain a Degree of Bachelor of Science.

Mathematical natural science courses

This block contains basic courses in mathematics and natural science and is chiefly located in year 1. The remaining courses are given in year 2.

Technology courses

This block includes basic engineering science courses within the field of materials, such as solid mechanics, thermodynamics, engineering materials and production processes for metals, ceramics, polymers and fibre-based materials. This block is begun in year 1 and concluded in year 3.

The first 3 years conclude with a first-cycle degree project worth 15 credits within a chosen technical field. After completing 180 credits, the student can apply for a technical Degree of Bachelor if the qualification requirements are met.

Years 4-5, Master's years 1-2, second-cycle studies

The Master's programmes represent a subject specialisation and consist mainly of advanced courses and a second-cycle degree project within one and the same engineering science discipline. Students on the Materials Design and Engineering Programme can choose from a wide range of Master's programmes with programme syllabuses established in advance. There is no restriction on the number of places for students on the Materials Design and Engineering Programme when choosing a Master's programme.

The engineer's knowledge of the environment and sustainable development is deepened and concretised through integrating the special aspects of, for example, life-cycle analysis, environmental impact and material selection, which are characteristic of the chosen Master's programmes, in the programme's courses.

Master's programmes that lead to a Degree of Master of Science in Materials Design and Engineering are found under the heading “Scope and content of the programme”:

The range of offered Master's programmes may be revised. An updated list of Master's programmes can be found on the KTH student web for each respective academic year.

Courses

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

The programme consists of compulsory, conditionally elective, recommended and optional courses. The compulsory courses are defined for each year in course lists. The goals, entry requirements, contents and course requirements for each course can be found in their respective course syllabuses.

The forms of teaching and examination vary between courses. These are indicated in each official course syllabus.
The optional courses can be chosen from KTH's range of offered courses. Credits from courses at other universities/higher education institutions can also be transferred.

The following limitations apply to optional courses:

- Optional courses may not be taken in year 1.
- There is a limit imposed on the number of credits that may be chosen per semester
- An optional course may not correspond to a significant extent to an existing programme course or an already credited course
- Higher education preparatory courses may not be counted as optional courses
- Optional courses may be chosen but should be relevant to the professional role of engineering

**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.

Grading scale is found in the course syllabus.

**Conditions for participation in the programme**

Participation requires admission to courses within the programme and course registration.

For studies at a higher study year there are specific admission requirements for the courses. Admission requirements are specified in the course syllabus.

**Requirements for admission to Master's Programme:**

*According to the KTH Admission regulations 2019-01-01 (Dnr. V-2018-0961)*

"In order to be eligible for advanced level studies within the integrated Master of Science programmes at KTH, you are required to complete 165 credits from year one through three. Of these, 110 credits must be from the year 1 and 2 curriculum. In addition to these credits, the bachelor thesis needs to be completed before Master’s level studies commence.

**Degree project**

*Degree project, first cycle*

Within the degree programme a degree project, first cycle, which comprises 15 credits, is included. The degree project course can be commenced when the special admission requirements listed in the course syllabus are fulfilled

*Degree project, second cycle*
Within the degree programme a degree project, second cycle, which comprises 30 credits, is included. The degree project course forms the final part of the degree programme in mechanical engineering. The degree project course can be commenced when the special admission requirements listed in the course syllabus are fulfilled.

**Degree**

In order to complete a Degree in Master of Science in Engineering, Degree Program Materials Design and Engineering, requires an approved grade in all courses included in the students study plan based on the degree programme. The study plan shall comprise 300 credits, which includes a degree project, first cycle comprising 15 credits and a degree project, second cycle comprising 30 credits.

Optional introductory courses and preparatory courses cannot be included as part of the degree.

Courses whose content is similar to one or more other courses within the programme cannot be counted as part of the 300 credits that form the basis for the degree.

- Title of general qualification at first cycle
  Bachelor of Science (180 credits)

- Title of professional qualifications at second cycle
  Degree of Master of Science in Engineering

- Title of general qualification at second cycle
  Degree of Master of Science (120 credits)
  Teknologie masterexamen

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

Degree Programme in Materials Design and Engineering (CMATD), Programme syllabus for studies starting in autumn 2019

General courses

Year 1

Mandatory courses (60.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>KD1260</td>
<td>Chemistry of Materials</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MH1070</td>
<td>Perspectives on Materials Design</td>
<td>13.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1624</td>
<td>Algebra and Geometry</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1625</td>
<td>Calculus in One Variable</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1626</td>
<td>Calculus in Several Variable</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SG1120</td>
<td>Mechanics I</td>
<td>9.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SK1117</td>
<td>Electromagnetism and Waves</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
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</table>

Year 2

Mandatory courses (61.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
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<th>Edu. level</th>
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</thead>
<tbody>
<tr>
<td>KF1050</td>
<td>Polymeric Materials</td>
<td>7.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MH1020</td>
<td>Ceramics</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MH1024</td>
<td>Fundamentals of Materials Science- Metallic Materials</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MH1025</td>
<td>Design, Profiling Course</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MH1027</td>
<td>Thermodynamics of Materials</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MH1028</td>
<td>Computational Thermodynamics for Materials Design</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SE1020</td>
<td>Solid Mechanics, Basic Course</td>
<td>9.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1518</td>
<td>Numerical Methods and Basic Programming</td>
<td>9.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1633</td>
<td>Differential Equations I</td>
<td>6.0 hp</td>
<td>First cycle</td>
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</table>
Year 3

Mandatory courses (31.0 Credits)

<table>
<thead>
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<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME1003</td>
<td>Industrial Management, Basic Course</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MH1018</td>
<td>Transport Phenomena</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MH1022</td>
<td>Fabrication Processes of Metals and Bio Fibres</td>
<td>7.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>MH2017</td>
<td>Micro and Nanostructures</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MH2050</td>
<td>Mechanical Properties of Materials</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

Supplementary information

Course list: Information is based upon the curriculum for academic year 2019/2020. Course list 2020/2021 is decided on November 1, 2019

Changes may occur.

Masters programmes within Materials Design and Engineering 2019/2020:
Sustainable Energy Engineering
Industrial Engineering and Management
Production Engineering and Management
Nuclear Energy Engineering
Macromolecular Material
Naval Architecture (the track Lightweight Structures)
Nanotechnology
Engineering Mechanics (track Solid Mechanics)
Engineering Materials Science (track Industrial Materials)
Engineering Materials Science (track Sustainable Materials)
Appendix 2: Specialisations

Degree Programme in Materials Design and Engineering (CMATD), Programme syllabus for studies starting in autumn 2019

This programme has no specialisations.