Programme syllabus

Degree Programme in Engineering Chemistry
Civilingenjörsutbildning i teknisk kemi
300.0 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

Knowledge and understanding

To obtain a Degree of Master of Science in Engineering Chemistry the student shall:

• Display knowledge of the importance of chemical, thermo dynamic and kinetic aspects of chemical reactions and processes.

• be able to apply knowledge of mathematics, numerical analysis and other natural sciences in the field of chemistry and chemical engineering.

• display advanced knowledge within a chemical or chemical engineering field, as well as insight into current research and development work.

Skills and abilities

To obtain a Degree of Master of Science in Engineering Chemistry the student shall:

• display skill in developing chemical products and design, run and control processes by applying a systematic thinking that includes the consideration of raw materials, energy, safety, environment, economy, human preconditions and needs, as well as societal goals concerning sustainable development.

• display skill in identifying, formulating and solving contemporary real problems found within industry, society and research, taking into account technical possibilities and limitations as well as formulating problems from a sustainable perspective.

• display skill in assessing the feasibility of derived solutions as well as comparing and evaluating alternative solutions.
• display experimental skills and knowledge concerning safe and environmentally correct handling of chemicals, as well as the ability, on a micro scale, laboratory scale and larger scale, to plan, carry out and assess experiments.

• display skill in utilising computer tools for simulation, technical calculation and information retrieval.

• display skill in presenting and discussing ideas and results, verbally and in writing, in Swedish and in English, with persons both with and without backgrounds in technical or natural sciences.

• display skill in efficiently working, planning and implementing projects, individually or as part of a group within given parameters.

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

• display the ability to critically review literature and techniques in areas related to chemistry and chemical engineering.

• display the ability to adopt a standpoint concerning ethical issues in the professional field.

• display an understanding of the fact that chemical and chemical engineering problems can be complex, insufficiently defined and may contain conflicting conditions, and also incorporate social, financial, business-related, environmental or work environment-related aspects.

• display the sufficient basic knowledge to be able to quickly acquire knowledge in new areas and to be able to apply new findings to the development and renewal of chemical products and chemical engineering processes.

**Extent and content of the programme**

The Engineering Chemistry Master's programme represents 300 higher education credits which, given a normal study pace, corresponds to 5 years of full-time studies (10 semesters).

The first three years (180 credits) of the programme are on a first-cycle level, and finish with a thesis for a Degree of Bachelor of Science. The two final years (120 credits) are carried out in one of the second-cycle level Master's programmes that can be chosen in the Degree programme in Engineering Chemistry and lead to a Degree of Master of Science in Engineering Chemistry within the chosen programme (see list below for the Master's programmes that can be chosen for the 2014/2015 academic year).

Comprehensive information about examination requirements for the Degree of Master of Science in Engineering, Bachelor of Science and Degree of Master can be found in the KTH Local regulation for qualifications, at www.kth.se.

**During the 2014/2015 academic year the following Master's programmes are offered for year 1-2, second-cycle level** *

• Chemical Engineering for Energy and the Environment
• Macromolecular Materials
• Molecular Science and Engineering
• Industrial and Environmental Biotechnology
• Medical Biotechnology

* 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.

Teaching language
The main teaching language for the first three years of the programme is Swedish, but English literature is often used. The final two years are in English. The language a course is being taught in is specified in the course syllabus found on the KTH student web.

Eligibility and selection
For admission to the Degree programme in Engineering Chemistry, the following entry requirements must be met:

Upper-secondary education before 1 July 2011 and upper-secondary adult education before 1 July 2012
Field-specific entry requirement 9 *. Specific entry requirements: Mathematics E, Physics B, chemistry A. Each subject requires a grade of Pass or 3.

Upper-secondary school from 1 July 2011 and upper-secondary adult education from 1 July 2012 (Gy2011)
Field-specific entry requirement A9. Specific entry requirements: Physics 2, Chemistry 1 and Mathematics 4. Each subject requires at least a Pass grade.

For entry requirements and selection principles see the KTH admission procedure, at www.kth.se

Implementation of the education

Structure of the education

The academic year for first-cycle education at KTH is divided into four periods. For more information see the current academic year "student at kth/timetables" at www.kth.se.

Academic years 1-3, first-cycle level
The programme syllabus for the Degree programme in Engineering Chemistry consists of the compulsory basic courses in study year 1-3 at undergraduate level and of a Master programme (second-cycle level) study year 4 and 5, which ends with a thesis of 30 ECTS credits.

In year 4 and 5 your study one of the five master programs :

• Chemical Engineering for Energy and the Environment
• Macromolecular Materials
• Molecular Science and Engineering
• Industrial and Environmental Biotechnology
• Medical Biotechnology
Study year 1 and 2 consists of first-cycle level courses in mathematics, physics, chemistry and chemical engineering. Study year 3 contains both applied chemical engineering subjects and basic courses, and includes a course specific to the programme in engineering for sustainable development with the involvement of industry. During the first years of the programme, leadership, economy and career planning are also integrated into the studies.

In study year 2 and 3, you have to study two of the four conditionally elective courses. The conditionally elective courses are

KD1270 Organic Chemistry, Basic Concepts and Practice 2, can be study during study year 2 or 3
KE1185 Chemical Engineering Systems, only in study year 3
language course, in study year 2 or 3
language course, in study year 3

The above can also be taken as elective courses in the Master programs given by the School of Chemical Science and Engineering. In addition to these courses are 7.5 credits free elective credits that can be study in year 2 or 3, depending on how the conditionally elective courses are taken.

NOTE: if you are going to study the master program Industrial and environmental biotechnology or Medical biotechnology you must replace one of the conditionally elective courses above or use the free elective ccredis and study the course BB1190 Gene Technology in study year 3.

Courses

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

The programme consists of mandatory, conditionally elective, recommended and elective courses. The compulsory courses for each academic year and focus are defined in the 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. Normally part of the course consists of lectures which introduce students to concepts and theories. Exercises, laboratory sessions, seminars, workshops, group assignments and assisted problem-solving contribute to improving the understanding of theoretical connections. The programme goals are reflected within the courses which have distinct connection, both in a specific year and between the years.

The elective courses can be chosen from KTH's offered courses. Credits from courses at other universities/higher education institutions can also be transferred if the examination requirements are met.

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
Semester registration
Semester registration is required for study results to be registered and for CSN to grant student funding.

Choice of courses

Application for admission to a course
Starting from year 1, the student is responsible for applying to the courses that they wish to take in the upcoming semester. This applies to compulsory, conditionally elective, recommended and elective courses that are part of the Bachelor/Master's programmes in Engineering.

Applications for admission to a course should be submitted
• 1-15 May for autumn semesters
• 1-15 November for spring semesters

If you need more information about how to fill out the application for admission to a course, contact the Education Office at the School of Chemical Science and Engineering. Applications submitted after deadline will be considered provided the course did not reach its maximum number of students.
Before applying for admission to a language course, a test concerning level placement should be conducted.

Course registration
Registration in a course presupposes being admitted to the course in Ladok. Application for admission to a course is either made online at Antagning.se or via the programme's Study Guidance. Registration in a course is done via "personal menu" or by the course’s department.
The student should, at the start of each course, register themselves on that course. Course registration on both compulsory and elective courses must be done individually at the school offering the courses. A person who has registered, but has decided not to proceed with a course, should inform the school offering the course of this as soon as possible.

Requirements for promotion
The following requirements for promotion apply for participation in subsequent study years.

Requirements for promotion from year 1 to year 2:
A total of at least 45 credits from year 1 should be completed.

Requirements for promotion from year 2 to year 3:
A total of at least 90 credits from years 1 and 2 should be completed, of which at least 50 credits are from year 1.

Requirements for promotion from year 3 to Master's programme year 1:
A total of at least 150 credits from years 1-3 should be completed, of which at least 110 credits are from years 1–2, as well as a Bachelor’s thesis.

Requirements for promotion from year 1 of the Master's programme to year 2:
In addition to what is required for promotion to year 1 of the Master's programme, at least 45 credits from year 1 should be completed.
Students who are lagging behind in their studies and do not meet the above requirements should, in consultation with the programme's Study Guidance, establish an individual study plan for the continuing studies.
Choice of Master's programme
In year 3 the student applies to the Master's programme that they intend to take in the final 2 years.
For more information about the Master's programme that can be taken as part of the Master of Science in Engineering programme, see descriptions in Appendix 2 and the programme syllabus for each respective Master's programme.

Entry requirements for Master's programmes
Students who, before the autumn semester of 2017, have met the requirements that apply for promotion from year 3 to year 1 of the Master's programme (see below) are eligible to begin a Master's programme.

• A total of 150 credits from years 1 to 3 should be completed, of which at least 110 credits are from years 1 and 2, as well as a Bachelor's thesis.

Students who do not meet the above requirements should, in consultation with the programme's Study Guidance, establish an individual study plan for the continuing studies.

Place limitations
KTH has a small number of courses with limited places and selection in these cases is based on merits such as grades and credits for students who have applied in time. The course syllabus specifies if the course has limited places and what type of selection grounds are applied. The selection is conducted by the school offering the course.

If a course is mandatory for one of the programme's Master's programmes, persons admitted to the Master's programme are prioritised ahead of other students, who are ranked based on the weighted average grade up until semester 5 of the programme.

Recognition of previous academic studies
Students have the opportunity to apply for recognition of their results from a course or courses at another higher education institution/university within or outside the country. The form can be found on the KTH website. The application for accreditation is submitted to the Education Office at the School of Chemical Science and Engineering.
The Head of first-cycle education at the school decides whether or not previous courses or parts of courses are recognised at the school.

The complete KTH policy for recognition of previous academic studies is found in the KTHs regulations, see www.kth.se

Courses that in contents overlap with another or other courses in the programme cannot be counted within the framework of the 300 higher education credits which form the basis for the degree.

Studies abroad
Students at the Degree programme in Engineering Chemistry have the opportunity to study one or two semesters abroad through agreements KTH has with universities within and outside the EU. Exchange studies are appropriate during the first or second year of the second-cycle level. It is also possible to write the second-cycle thesis abroad.
For more information see; "student at kth/during a program/study abroad" at www.kth.se or contact the international coordinator at students office.

Degree project

Thesis, first-cycle level
The programme includes a thesis for a Degree of Bachelor of Science in year 3, which is a course worth 15 credits.
To being working on the thesis, the student must have completed the majority of their studies – at least 120 higher education credits.

KTH's comprehensive rules and guidelines for a thesis, 15 credits, for a Degree of Bachelor of Science, 180 credits, as well as how the thesis is graded, can be found in the KTHs regulations, at www.kth.se

Thesis, second-cycle level
The programme includes a thesis for the Degree of Master of Science in Engineering/Degree of Master of Science which corresponds to 30 credits.
To being working on the thesis, the student must have completed the majority of their studies – at least 240 higher education credits.

KTH's comprehensive rules and guidelines for a thesis, 30 credits, for a Degree of Master of Science in Engineering, 300 credits, as well as how the thesis is graded, can be found in the KTHs regulations, at www.kth.se

A second-cycle thesis for the Degree of Master of Science in Engineering Chemistry can be conducted in the following thesis subjects:
Chemistry, Chemical Engineering, Fibre and Polymer Technology and Biotechnology.
Other thesis subjects may be permitted following an application for permission addressed to the Head of first-cycle education. For more information contact the Education Office of the School of Chemical Science and Engineering.

Degree

Applying for a degree
To obtain a Degree of Master of Science in Engineering, Degree Programme in Engineering Chemistry,

a student is required to have a Pass grade in courses totalling 300 credits including one of the five Master's programmes: Molecular Science and Engineering, Chemical Engineering for Energy and the Environment, Macromolecular Materials, Industrial and Environmental Biotechnology eller Medical Biotechnology.
The 300 credits should include:

1. First-cycle level thesis, 15 credits,
3. Mathematical or natural science subjects of at least 45 credits and a minimum of an additional 180 credits (including a 30 credit thesis) in subjects central to the field of technology.
4. At least 90 credits at the second-cycle level, of which at least 60 credits (including a 30 credit thesis) are in subjects central to the field of technology, i.e., Chemical Science and Engineering.
Degree of Bachelor of Science
The first three years will give the student opportunities to be awarded a Degree of Bachelor of Science. The programme is designed so that the student, having earned their degree, meets the national examination requirements and has completed courses of 180 credits including

• A first-cycle level thesis of 15 credits.
• Mathematical or natural science subjects of at least 25 credits.
• At least 90 credits (including a 15 credit joint thesis) of gradually more in-depth studies in the programme's main area.

A Degree of Master of Science is awarded after finishing the programme. The programme is designed so that the student, having earned their degree, meets the national examination requirements and has completed courses of 120 credits, including
• At least 90 credits at a second-cycle level, of which at least 60 credits (including a 30 credit thesis) are from gradually more in-depth studies in the programme's main area.

References to KTH regulations
Lokala föreskrifter för examina på grundnivå och avancerad nivå, lokal examensordning at www.kth.se.

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

Degree Programme in Engineering Chemistry (CTKEM), Programme syllabus for studies starting in autumn 2014

General courses

Year 1

Mandatory courses (65.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>KA1030</td>
<td>Perspectives on Research and Innovation</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KD1230</td>
<td>Organic Chemistry, Basic Concepts and Practice</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KD1280</td>
<td>Chemical Analysis</td>
<td>10.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KE1140</td>
<td>Engineering Chemistry</td>
<td>14.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>ME1402</td>
<td>Project Management for Chemistry Engineering Students</td>
<td>6.0 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>
</tbody>
</table>

Optional courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE1110</td>
<td>Introductory Course in Chemistry</td>
<td>1.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1611</td>
<td>Introductory Course in Mathematics I</td>
<td>1.5 hp</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

Supplementary information

Study year 1 consists of mandatory courses.

Year 2

Mandatory courses (53.5 Credits)
<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM1601</td>
<td>Elementary Physics</td>
<td>9.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KA1030</td>
<td>Perspectives on Research and Innovation</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KD1070</td>
<td>Molecular Structure</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KD1080</td>
<td>Chemical Dynamics</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KE1160</td>
<td>Thermodynamics</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KE1170</td>
<td>Transport Phenomena</td>
<td>7.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1520</td>
<td>Numerical Methods and Basic Programming, part 1</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1633</td>
<td>Differential Equations</td>
<td>6.0 hp</td>
<td>First 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>KD1270</td>
<td>Organic Chemistry, Basic Concepts and Practice 2</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

Supplementary information

This is a preliminary list of courses for study year 2 for those who started the program 2014. There might be changes.

In study year 2 you have to study mandatory courses and a conditionally elective course.

The conditionally elective courses are:
KD1270 Organic Chemistry, Basic Concepts and Practice 2 (can be study during study year 2 or 3)
Language course (in study year 2 or 3)

NOTE: if you are going to study the master program Industrial and environmental biotechnology or Medical biotechnology you must replace one of the conditionally elective courses above or use the free elective credits and study the course BB1190 Gene Technology in study year 3.

You must study KD2170 Organic Chemistry, basic concepts and practice 2 as one of the conditionally elective courses during study year 2 or 3 period 4 or use the free elective credits at the master program to be eligible to take the course KD2310 Advanced Organic Chemistry.

Year 3

Mandatory courses (45.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB1050</td>
<td>Biotechnology</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KA1015</td>
<td>Chemistry for Sustainable Development</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KA103X</td>
<td>Degree Project in Engineering Chemistry, First Cycle</td>
<td>15.0 hp</td>
<td>First cycle</td>
</tr>
</tbody>
</table>
KE1175  Chemical Process Engineering  6.0 hp  First cycle
KF1165  Materials Chemistry and Properties  9.0 hp  First cycle
SF1521  Numerical Methods and Basic Programming, Part 2  3.0 hp  First cycle

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>KD1270</td>
<td>Organic Chemistry, Basic Concepts and Practice 2</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KE1185</td>
<td>Chemical Engineering Systems</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

Supplementary information

This is a preliminary list of courses for study year 3 for those who started the program 2014. There might be changes.

In study year 3, you have to study mandatory courses, 1 conditionally elective course and an elective course. The study year concludes with a degree project, first level

The conditionally elective courses are:
KD1270 Organic Chemistry, Basic Concepts and Practice 2 (can be study during study year 2 or 3)
KE1185 Chemical Engineering Systems (only in study year 3)
Language course (in study year 2 or 3)
Language course (in study year 3)

NOTE: if you are going to study the master program Industrial and environmental biotechnology or Medical biotechnology you must replace one of the conditionally elective courses above or use the free elective credits and study the course BB1190 Gene Technology in study year 3.

You must study KD1270 Organic Chemistry, basic concepts and practice 2 as one of the conditionally elective courses during study year 2 or 3 period 4 or use the free elective credits at the master program to be eligible to take the course KD2310 Advanced Organic Chemistry.

Year 4

Supplementary information

During study year 4 and 5 one of the five Masters programme should be taken:

Master Programme - Chemical Engineering for Energy and the Environment,

Master Programme - Macromolecular Materials

Master Programme - Molecular Science and Engineering

Master Programme - Industrial and Environmental Biotechnology
To study the above master programme you should have read
- BB1190 Gene Technology (7.5 credits), study year 3, Period 4, as an optional course.
Courses which are mandatory for students from CTKEM:
- BB1030 Microbiology (9 credits), period 3
- BB1120 Cultivation Technology (7.5 credits), period 2

**Master Programme - Medical Biotechnology**
To study the above master programme you should have read
- BB1190 Gene Technology (7.5 credits), study year 3, Period 4, as an optional course.
Courses which are mandatory for students from CTKEM:
- BB1030 Microbiology (9 credits), period 3
- bb1160 Eucaryotic Cell Biology (7.5 hp), period 2

For more detailed information about the programme, see student at kth/course and programme directory at www.kth.se

**Year 5**

**Supplementary information**

During study year 4 and 5 one of the three Masters programme should be taken:
*Chemical Engineering for Energy and the Environment*
*Macromolecular Materials*
*Molecular Science and Engineering*
*Industrial and Environmental Biotechnology*
*Medical Biotechnology*

Study year 5 ends with a degree project, second level, 30 credits.
Appendix 2: Specialisations

Degree Programme in Engineering Chemistry (CTKEM), Programme syllabus for studies starting in autumn 2014

This programme has no specialisations.