Programme syllabus

Degree Programme in Biotechnology
Civilingenjörsutbildning i bioteknik

300.0 credits

Valid for students admitted to the education from autumn 20 (HT - Autumn term; VT - Spring term).

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

Programme objectives

Knowledge and understanding

For a Master of science in engineering degree in Biotechnology, the student should:

- demonstrate knowledge of the scientific basis and proven experience of biotechnology and insight into current research and developmental work
- show both broad knowledge in biotechnology, including knowledge in mathematics and science, as well as significant in-depth knowledge in certain parts of the field

Skills and abilities

For a Master of science in engineering degree in Biotechnology, the student should:

- demonstrate the ability to critically, independently and creatively identify, formulate and manage complex issues with a holistic approach and to participate in research and developmental work and thereby contribute to the development of knowledge;
- demonstrate the ability to create, analyze and critically evaluate various technical solutions;
- demonstrate the ability to plan and execute, using appropriate methods, complex tasks within a given framework;
- demonstrate the ability to critically and systematically integrate knowledge
- demonstrate the ability to model, simulate, predict and evaluate events even with limited information;
- demonstrate the ability to develop and design products, processes and systems with regard to people's conditions and needs and society's goals for economically, socially and ecologically sustainable development;
- show ability for teamwork and collaboration in groups with different compositions
• demonstrate the ability, both in writing and orally, both in national and international contexts, to clearly explain and discuss in dialogue with various groups their conclusions and the knowledge and arguments that underlie them.

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

For a Master of science in engineering in Biotechnology, the student should be able to

• demonstrate the ability to make judgments with regard to relevant scientific, social and ethical aspects as well as show awareness of ethical aspects in research and developmental work;
• show insight into the possibilities and limitations of technology, its role in society and people's responsibility for its use, including social and economic aspects, as well as environmental and work environment aspects, and
• demonstrate the ability to identify their need for additional knowledge and to continuously develop their skills.

**Extent and content of the programme**

The Master of science in engineering in Biotechnology includes 300 higher education credits, which is equivalent to 5 years of full-time studies (10 semesters). During the first three years (180 higher education credits), basic courses in the major field of study in biotechnology, as well as other technical fields of study such as chemistry, mathematics, physics and engineering skills are read. Year 3 concludes with a thesis for the Bachelor of science in engineering degree. Prior to year 4 and 5, one of four master programmes (120 higher education credits) is selected and courses are taken at the advanced level, according to the respective program. The program concludes with an independent degree project. After completed studies, a Master of science in engineering degree is obtained.

The master programmes offered are:

• Industrial & environmental biotechnology
• Medical biotechnology
• Macromolecular Materials *
• Molecular science and technology **

* To obtain a Master of science in engineering degree in Biotechnology, you must choose 2 of the following courses; BB2460 Biocatalysis, 7.5 credits, BB2020 Molecular Enzymology, 7.5 credits, BB2425 Glycobiotics, 7.5 credits

** To obtain a Master of science in engineering degree in Biotechnology, the following courses should be taken BB2460 Biocatalysis, 7.5 credits and BB2020 Molecular Enzymology, 7.5 credits

The offered master programmes may be revised. An updated list of master programmes can be found on KTH's student web site for each academic year.

**Language**
The language of instruction for the first three years of education is mainly Swedish, but English literature is common. The final two-year courses are given in English. The language of a course is in the syllabus on KTH’s student web site.

**Eligibility and selection**

Admission to the Master of science in engineering in biotechnology requires the following:

Basic eligibility for university studies including prior knowledge in Swedish and English and see below;

**Secondary school before July 1, 2011 and upper secondary education before July 1, 2012**

Area access 9 *

**Special eligibility:**

Mathematics E, physics B and chemistry A. In each of the subjects the grade Pass or 3 is required.

**Secondary school from 1 July 2011 and upper secondary education from 1 July 2012 (Gy2011)**

Area permission A9 *

**Special eligibility:**

Physics 2, Chemistry 1 and Mathematics 4. In each of the subjects, a passing grade is required.

* For more information on area permissions, see www.hsv.se

For eligibility requirements and selection principles, see KTH's admission scheme at www.kth.se

**Implementation of the education**

**Structure of the education**

**Academic year**

The KTH academic year is 40 weeks, divided into four periods. The study periods correspond to about seven weeks. Each study period is followed by an examination period. For details about the structure of the academic year see; "student at kth/timetables" at www.kth.se.

**First cycle**

The first three years consists of compulsory courses in natural sciences to provide fundamental knowledge and skills. The Study programme contains courses in Biotechnology, Chemistry, Mathematics and Engineering skills but it also includes two conditionally elective courses. The cycle also contains two independent projects and a diploma at the level of Bachelor of Science in Biotechnology.

The course curriculum is presented in appendix 1.
Second cycle
During the second cycle, study year 4 and 5, one of the following master programmes are studied:

Industrial and Environmental Biotechnology, Medical Biotechnology, Macromolecular Materials, Molecular Science and Engineering.

The Master selection is done 1-15 May.

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
Participation requires admission to courses within the programme and course registration. Course registration is done via the personal menu at www.kth.se

If a student registers for a course and then decides to not continue, the student must report this as soon as possible.

For students starting their education from the autumn semester 2018, previous promotion requirements have been replaced with special admission requirements to each course. Admission requirements are specified in the course syllabus.

Application for admission to courses will be made at:

- 1th-15th of May for the fall term.
- 1th-15th of November for the spring term.

In order to be eligible for advanced level studies within the integrated Master of Science programmes at KTH, you are required to complete 150 ECTS credits from year one through three. Of these, 110 ECTS 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.

Selecting a masters programme

Industrial and Environmental Biotechnology
You should study the conditionally elective courses BB1070 Genetics and KD1270 Organic Chemistry, Basic Concepts and Practice 2.

Medical Biotechnology
You should study the conditionally elective course BB1070 Genetics.
Macromolecular Materials
You should study the conditionally elective KD1070 Molecular Structure.

Molecular Science and Engineering
You should study the conditionally elective course D1070 Molecular Structure and KD1270 Organic Chemistry, Basic Concepts and Practice 2.

Degree project

Degree project, first level
The diploma work done in grade 3 is a thesis for a Degree of Bachelor of Science conducted in a course of 15 credits.

The degree project is the final part of the first level education. The project work may begin when special admission requirements for the course are fulfilled.

Degree project, advanced level
In the programme a final diploma work is done, i.e. a thesis for the Degree of Master of Science in Engineering/Master of Science (120 credits) corresponding to 30 credits.

The degree project is the final part of the second level education. The project work may begin when special admission requirements for the course are fulfilled.

For further information see KTH comprehensive rules and guidelines for thesis 30 credits at www.kth.se

Degree

Degree Name
Civilingenjörsexamen
Degree of Master of Science in Engineering, Degree Programme in Biotechnology

Conditions for the Degree of Master of Science in Engineering 300 credits
The Master of Science in Engineering degree is received after completing all the courses at the first and second cycles of education at the degree programme in biotechnology according to the programme specifications.

Students taking the master programs Macromolecular Materials or Molecular Science and Engineering, should have at least 15 credits of biotechnology courses at advanced level.

Application for graduation Students are requested to apply for the degree through the web service by logging into Personal menu/Application for degrees. For further information see www.kth.se

It is possible to apply for the following degrees: Degree of Master of Science in Engineering; Degree Programme in Biotechnology, Degree of Bachelor of Science and Degree of Master of Science.

For further information see; "Local regulation for qualifications at first and second cycle" at www.kth.se
Appendix 1 - Course list
Appendix 2 - Programme syllabus descriptions
Appendix 1: Course list

Degree Programme in Biotechnology (CBIOT), Programme syllabus for studies starting in autumn 2020

General courses

Year 1

Mandatory courses (57.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB1030</td>
<td>Microbiology</td>
<td>9.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>BB1150</td>
<td>Biochemistry 1</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>BB1160</td>
<td>Eucaryotic Cell Biology</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>BB1170</td>
<td>The Engineer in Focus</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KD1020</td>
<td>Introductory Chemistry</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>KE1180</td>
<td>Introduction to Chemical Engineering</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>
</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>KE0110</td>
<td>Introductory Course in Chemistry</td>
<td>1.5 fup</td>
<td>Pre-university level</td>
</tr>
<tr>
<td>SF0003</td>
<td>Introductory Course in Mathematics</td>
<td>1.5 fup</td>
<td>Pre-university level</td>
</tr>
</tbody>
</table>

Supplementary information

Study year 1 consists of mandatory courses.

Year 2

Mandatory courses (64.5 Credits)
### Year 2

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB1000</td>
<td>Programming in Python</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>BB1170</td>
<td>The Engineer in Focus</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>BB1200</td>
<td>Analysis of Biomolecules</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>BB1210</td>
<td>Purification of Biomolecules</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>BB1230</td>
<td>Biochemistry 2</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>CB1010</td>
<td>Project in Sustainable Development</td>
<td>3.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KD1510</td>
<td>Chemical Equilibrium</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1524</td>
<td>Basic Numerical Methods and Programming</td>
<td>7.5 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>SK1150</td>
<td>Fundamental Physics I</td>
<td>9.0 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 2020. There might be changes.

Study year 2 consists of mandatory courses.

SF1524 - Basic Numerical Methods and Programming, will be repalce with a new 6 credits course.

### Year 3

#### Mandatory courses (51.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB103X</td>
<td>Degree Project in Biotechnology, First Cycle</td>
<td>15.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>BB1170</td>
<td>The Engineer in Focus</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>BB1300</td>
<td>Cultivation Technology</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>CB1020</td>
<td>Project in Mathematical Modelling</td>
<td>3.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KD1500</td>
<td>Physical Biochemistry</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1911</td>
<td>Statistics for Bioengineering</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SI1410</td>
<td>Basic Modeling in Biotechnology</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>BB1070</td>
<td>Genetics</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

Mandatory for master programme TIMBM and TMBIM

Molecular Structure
Supplementary information

This is a preliminary list of courses for study year 3 for those who started the program 2020. There might be changes.
Study year 3 consists of mandatory courses, 2 conditionally elective courses and ends with a degree project, first level.

The course KD1070 is mandatory for the masterprogrammes in Macromolecular Materials (TMMMM) and Molecular Science and Engineering (TMVTM).

The course BB1070 Genetics is mandatory for the masterprogrammes in Industrial and Environmental Biotechnology (TIMBM) and Medical Biotechnology (TMBIM).

Information regarding conditionally elective courses

During year 3 you have to study two of the courses below:

- KD1270 Organic Chemistry, Basic Concepts and Practice 2
- SF1626 Calculus in Several Variable
- BB1070 Genetics
- KD1070 Molecular Structure

Observe - you must study KD1270 - Organic Chemistry, basic concepts and practice 2, as the conditionally elective course or use the free elective credits at the master program to be eligible to study the course KD2310 - Advanced Organic Chemistry.

Year 4

Supplementary information

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

- Master - Industrial and Environmental Biotechnology
- Master - Medical Biotechnology
- Master - Macromolecular Materials
- Master - Molecular Science and Engineering

Year 5

Supplementary information

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

- Master - Industrial and Environmental Biotechnology
Master - Medical Biotechnology
Master - Macromolecular Materials
Master - Molecular Science and Engineering

Study year 5 ends with a degree project, second level, 30 credits.

Master, Industrial and Environmental Biotechnology (IMB)

Master, Medical Biotechnology (MBI)

Master, Macromolecular Materials (MMM)

Master, Molecular Science and Engineering (MVT2)
Appendix 2: Specialisations

Degree Programme in Biotechnology (CBIOT), Programme syllabus for studies starting in autumn 2020

Master, Industrial and Environmental Biotechnology (IMB)

The overall goal of this program is that students will gain the insight and knowledge needed to use biotechnology to produce chemicals, materials and energy and thus assist in creating a sustainable society. The program provides a deeper understanding of the metabolic, physiological and genetic basis for the use of enzymes and microorganisms in biotechnological production systems. Understanding of the global pollution and destruction of the environment is an important part of education and to contribute to an improvement in these areas is a major challenge for new engineering graduates. One important tool is an efficient use of biotechnological methods to understand and solve this problem.

For more detailed information about the Master programme (Two Years), Industrial and Environmental Biotechnology, see "student at kth/ course and programme directory" at www.kth.se.

Master, Medical Biotechnology (MBI)

The program aims to provide depth in the fields of biotechnology, in which molecular techniques play a central role, with particular emphasis on medical applications. The goal is to provide the prospective civil engineers in biotechnology unique expertise in the border area, chemistry, biology and medicine and provide a high level of competitiveness in the Swedish and foreign labor in the pharmaceutical and biotechnology industries as well as in research. The program includes courses in genomics and proteomics, which contains a large number of technical methods for analyzing cell activity on DNA, RNA and protein level. Bioinformatics provides an insight into how the huge amounts of data produced can be handled by computers. The program also includes courses that provide knowledge about the structure of biomolecules can be determined and how the process looks to develop drugs from the first discovery of an active molecule.

For more detailed information about the Master programme (Two Years), Medical Biotechnology, see "student at kth/ course and programme directory" at www.kth.se.

Master, Macromolecular Materials (MMM)

To obtain the Degree of Master of Science in Engineering, Degree Programme in Biotechnology, the student must take 2 of these courses;
BB2460 Biocatalysis, 7.5 credits  
BB2020 Molecular Enzymology7.5 credits  
BB2420 Glycobiology and Carbohydrate Technology, 7.5 credits

For more detailed information about the Master programme (Two Years), Macromolecular Materials, see "student at kth/ course and programme directory" at www.kth.se.

**Master, Molecular Science and Engineering (MVT2)**

To obtain the Degree of Master of Science in Engineering, Degree Programme in Biotechnology, the student must take these courses;
BB2460 Biocatalysis, 7.5 credits  
BB2020 Molecular Enzymology7.5 credits

For more detailed information about the Master programme (Two Years), Molecular Science and Engineering, see "student at kth/ course and programme directory" at www.kth.se.