Programme syllabus

Master's Programme, Industrial and Environmental Biotechnology, 120 credits
Masterprogram, Industriell och miljöinriktad bioteknologi
120.0 credits

Valid for students admitted to the education from autumn 12 (HT - Autumn term; VT - Spring term).

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

Programme objectives

Knowledge and understanding
After completing the Industrial and Environmental Biotechnology programme the students should:

- be able to design central parts in bioprocesses both in the industrial and the environmental setting.
- understand and manage processes at both molecular-, cellular and engineering level.
- have subject knowledge and understanding to a level which promotes a future career in the field of the programme including research education.
- be able to communicate with colleagues in the various subject areas of biotechnology.
- have in-depth knowledge in a chosen biotechnology subject area.
- understand the driving forces, organization and management of Swedish and International Biotech industry.

Skills and abilities
After completing the Industrial and Environmental Biotechnology programme the students should:

- be able to critically read and extract information from various sources, formulate conclusions and integrate this into the design work.
- know how to analytically and critically plan, execute and evaluate experiments.
- be able to use standard and advanced biotechnology methods and techniques.
- be skillful in technical communication, both in oral and written form.

Ability to make judgements and adopt a standpoint
After completing the Industrial and Environmental Biotechnology programme the students should:

- be able to critically evaluate existing and new technology breakthroughs in the biotech society.
- use biotechnology methods, products and processes in a responsible way understanding its limitations and economic impact.
- understand the impact of biotechnology developments on social, ethical and gender level.
- understand the implications of biotechnology development in the context of a sustainable society.
**Extent and content of the programme**

Industrial and Environmental Biotechnology is a two-year (120 credits) master programme second cycle. The instruction language is entirely in English. The programme consists of courses given by KTH.

**Eligibility and selection**

**General admission requirements**
A completed Bachelor's degree - corresponding to a Swedish Bachelor's degree (180 credits), or equivalent academic qualifications from an internationally recognized university.

**Language requirements** – applicants must proof their proficiency in English, which is most commonly established through an internationally recognized test.

**Documentation** – for detailed information about list of required documents, see “Admission requirements and selection” http://www.kth.se/en/studies/programmes/master/admission?l=en_UK

**Specific admission requirements**
In addition to the general admission requirements, the programme requires:

- Courses in *biochemistry, microbiology and gene technology/molecular biology* with a total of at least 20 credits
- Courses in *chemistry* for at least 30 credits
- Basic knowledge in *mathematics, numerical analysis and computer science* with a total of at least 20 credits.

For more information, see Study at KTH, Master’s programmes at KTH, “Admission requirements”.

**Selection process**
The selection process for the *Industrial and Environmental Biotechnology* programme is based on a total evaluation of the following criteria: university, grade point average (GPA), courses relevant to the programme, motivation letter, relevant work experience, references, list of qualifications for specific requirements and English proficiency.

Complete information on the eligibility requirements can be found in the local admission policy of KTH, see: http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/antagning/antagning-till-master-och-magisterprogram-pa-avancerad-niva-med-undervisning-pa-engelska-1.27192?l=en_UK

**Implementation of the education**

**Structure of the education**
The duration of a study year at KTH is 40 weeks, and is divided into four study periods, where two or three courses are simultaneously studied in each period. The nominal study pace is 60 credits each study year.

The mandatory courses comprise 43,5 credits (international students 49,5) during the first study year, and 45 credits (of which the degree project, advanced level is 30 credits) during the second study year. The student can elect the rest of the courses freely, but are encouraged to chose certain courses that will lead to either of two distinct profiles, “Industrial-Process design” (track 1) or “Environmental-Environmental systems analysis” (track 2). The list of courses in appendix 1 contains a group of selected recommended courses.

**Courses**
The programme is course-based. Lists of courses are included in appendix 1.
Teaching and examination methods vary between courses. During the first year, the concepts and theory of a subject is taught through lectures. Exercises, seminars and laboratory sessions aim to emphasize and deepen the understanding of the most important aspects of a subject. The second year is almost exclusively run in project format. The programme is concluded with a degree project, advanced level equivalent to 30 credits. To receive a Master of Science (120 credits) the students should have passing grades in all the mandatory and optional courses, which including the thesis will comprise 120 credits.

**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**

Students accepted to the programme will start the programme in the end of August when the registration also takes place and where the student must be present in person. The students are thereafter required to make a study registration and course selection for the coming term no later than November 15 and May 15 each study year, respectively. At least 45 credits have to be completed during the first study year (including the re-examination period in August) in order for the student to be promoted to the second year of the programme.

Students who have not passed 45 credits in the first year must contact the programme coordinator for an individual study plan, otherwise the student will not be registered on any courses in the upcoming study year. This study plan will include residual courses and appropriate courses for the upcoming year.

**Recognition of previous academic studies**

The students have the right to transfer credits from previous studies at universities in or outside of Sweden. The courses have to be at a level and include contents that agree with the goals of the programme. Transfer of credits are decided by the director of undergraduate and Masters’ studies.

For more information see:

**Studies abroad**

For information about studies abroad, contact the international coordinator at the School of Biotechnology.

**Degree project**

Students admitted to the programme are required to perform an individual study in the form of a degree project corresponding to 30 credits. The main portion of the studies must be completed before the start of the degree project, specifically those related to the mandatory courses of the programme. This means that at least 60 credits (of which 30 must be in the second cycle within the main field of study) have to be completed before the start of the degree project.

The purpose of the degree project is for the student to demonstrate the ability to perform an independent project, using skills obtained during the courses in the programme. It is the student's responsibility to find a suitable thesis project, with assistance from KTH.

Degree project, advanced level for the Degree of Master of Science, Biotechnology, can be performed in the following exam topics:

*Biotechnology.*

Other degree projects in related fields may also be allowed, but need approval by the Director of Undergraduate and Masters’ studies at the School of Biotechnology.

For more information, contact the study advisor at the BIO students office.
Grading of the degree project is done by a seven step goal-related grading system (A to F), where A-E are passing grades and A is the highest. The grade is based on three evaluation criteria:

- the process of planning and performing the degree project within the given timeframe.
- the use of engineering approach and skills when performing the degree project.
- the oral and written presentation of the degree project.

More information on the KTH policy on the degree project can be found at: http://intra.kth.se/en/regelverk/utbildning-forskning/grundutbildning/examensarbete/overgripende-regler-och-riktlinjer-for-examensarbete-30-hogskolepoang-for-masterexamen-120-hogskolepoang-samt-betygssattning-av-examensarbete-1.27212

**Degree**

Master of Science (120 credits) - is obtained after completion of the Industrial and Environmental Biotechnology programme. The programme is designed so that students, when they graduate, have fulfilled Swedish national requirements for a degree and have completed courses comprising 120 credits, of which:

- at least 90 credits are at second cycle, of which at least 60 credits (including 30 credits degree project) are in-depth studies in the main field of the programme.

Within the programme the mandatory courses, conditionally elective courses and the recommended courses must add up to at least 105 credits. The final credits can be chosen by the student but should be relevant to the professional role as an engineer.

Students must apply for the degree at the student office and are required to show proof of their basic degree (Bachelor or similar).

**Degree name**

Master of Science (120 credits)
Teknologie masterexamen

For more information see “Local regulation for degrees at first and second cycle, local system of qualifications”

http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/examina/1.27227?l=en_UK

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

Master's Programme, Industrial and Environmental Biotechnology, 120 credits (TIMBM), Programme syllabus for studies starting in autumn 2012

General courses

Year 1

Mandatory courses (43.5 credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK2036</td>
<td>Theory and Methodology of Science with Applications (Natural and Technological Science)</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>BB2020</td>
<td>Molecular Enzymology</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>BB2450</td>
<td>The Cell Factory</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>BB2460</td>
<td>Biocatalysis</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>BB2480</td>
<td>Energy and Environment</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ME1003</td>
<td>Industrial Management, Basic Course</td>
<td>6.0</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>BB1120</td>
<td>Cultivation Technology</td>
<td>6.0</td>
<td>First cycle</td>
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</tbody>
</table>

Recommended courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK2008</td>
<td>Ethics of Biotechnology</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>BB2010</td>
<td>Environmental Toxicology</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>BB2160</td>
<td>Structure Biology</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>BB2170</td>
<td>Drug Development</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>BB2280</td>
<td>Molecular Modeling</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>BB2330</td>
<td>Plant Biotechnology</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>Course code</td>
<td>Course name</td>
<td>Credits</td>
<td>Edu. level</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------</td>
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<td>-----------------</td>
</tr>
<tr>
<td>BB2420</td>
<td>Glycobiology and Carbohydrate Technology</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>KD2310</td>
<td>Advanced Organic Chemistry</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>KD2320</td>
<td>Spectroscopic Tools for Chemistry</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2627</td>
<td>Environmental Technology, Larger Course</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2629</td>
<td>Environmental Technology, Theory Course</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2640</td>
<td>Cleaner Production</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2655</td>
<td>Technology and Ecosystems</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

**Supplementary information**

Study year 1 consists of mandatory courses and recommended courses.

International students have to take the course MJ2640/MJ2655 if the plan is to take the course MJ2624 during study year 2.

One of the courses MJ2627 or MJ2629 must be taken by the students admitted to Degree Programme in Biotechnology, and are planning to take the course MJ2624 during study year 2.

**Year 2**

**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>BB201X</td>
<td>Degree Project in Biotechnology, Second Cycle</td>
<td>30.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>BB2520</td>
<td>Bioprocess Design</td>
<td>15.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

**Recommended courses**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE2320</td>
<td>Process Design for Industry and Society</td>
<td>15.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2624</td>
<td>Project in Environmental Technology</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2627</td>
<td>Environmental Technology, Larger Course</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2635</td>
<td>Environmental Modelling: Introduction and Application Examples</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2682</td>
<td>Applied Environmental System Analysis</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

**Supplementary information**

This is a preliminary list of courses for study year 2 for those who started the program 2012. There might be changes. For a correct updated list, see the study handbook for the respective study year.

Study year 2 consists of mandatory courses, conditionally elective and recommended courses, and ends with a degree project, second level, 30 credits.
Appendix 2: Specialisations

Master's Programme, Industrial and Environmental Biotechnology, 120 credits (TIMBM), Programme syllabus for studies starting in autumn 2012

This programme has no specialisations.