Master Programme in Resource Recovery - Biotechnology and Bioeconomy

Masterprogram i Resursåtervinning - bioteknik och bioekonomi

120 credits

Ladok Code: TAREB
Version: 4.1
Level: Second cycle
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General Objectives

Second level education shall essentially build on the knowledge that students acquire in first level education or corresponding knowledge. Second level education shall involve a deepening of knowledge, skills and abilities relative to first level education and, in addition to what applies to first level education, shall

- further develop the students' ability to independently integrate and use knowledge,
- develop the students' ability to deal with complex phenomena, issues and situations, and
- develop the students' potential for professional activities that demand considerable independence or for research and development work.

(The Higher Educations Act, Chapter 1, Section 9)

Objectives

Educational programme's goals

The overall goal of the educational programme is to provide the student with knowledge and skills in order to develop and implement systems, engineering, and technology that promote a more resource-efficient society, especially in the materials, energy, and recycling sectors. In this context, the programme is also to provide knowledge and skills that the student can take into account and critically examine when it comes to sustainability aspects, international aspects, and ethical issues. The aim of the programme is to prepare the student for doctoral education, as well.

Upon completion of the programme, the student is to be able to:

1. Knowledge and understanding

• demonstrate knowledge and understanding of resource recovery, including both broad knowledge and substantially specialised knowledge in certain areas of resource recovery as well as specialised insight into current research and development work.
• The student should also demonstrate specialised methodological knowledge in resource recovery.

2. Skills and abilities

• based on complex phenomena, problems, and situations related to resource recovery, even with limited information, have the ability to critically and systematically integrate knowledge and analyse, assess, and process it from a technical, economic, environmental, and social perspectives.
• demonstrate the ability to critically, independently, and creatively identify and formulate questions as well as plan and, with adequate methods, carry out and evaluate qualified tasks within given time frames and thereby also contribute to the development of knowledge.
• orally and in writing clearly recount and discuss conclusions and results and the knowledge and arguments on which they are based in dialogue with different groups, both in national and international contexts.
• have acquired the skills required to participate in research and development work or to work independently in other qualified settings.

3. *Evaluation ability and approach*

• demonstrate the ability to make assessments in the main area of resource recovery with regard to scientific, societal, and ethical aspects and demonstrate awareness of ethical aspects of research and development work.
• demonstrate insight into the possibilities and limitations of science and technology, their role in society, and people's responsibility for how they are used.
• demonstrate the ability to identify their own need for additional knowledge and to take responsibility for their own knowledge development.

Content

The educational programme consists of two years of full-time studies and is strongly linked to the research conducted within the research area Resource Recovery at the University of Borås. All courses are within the main field and are classified as being at the Advanced/Master's level (Second-cycle).
Since the main area of resource recycling requires a multidisciplinary approach, the course offerings during the first term aim to give the students broad knowledge and understanding of the main field. The students are also to be provided conditions for specialisation when it comes to biotechnology and bioeconomy, which takes place during the second term. In year two, methodological knowledge and knowledge are further specialised within resource recovery with a focus on biotechnology and bioeconomy through the degree project. The degree project is divided into two parts, Degree Project 1 and 2.

Term 1
The courses given during the first term are as follows:

• Resource Recovery 1, 7.5 ECTS credits
• Resource Recovery 2, 7.5 ECTS credits
• Life Cycle Assessment, 5 ECTS credits
• Circular Economy, 5 ECTS credits
• Theory of Science and Research Methodology, 5 ECTS credits

Resource Recovery 1 provides an overview of how waste is currently handled internationally and nationally, legislation, as well as waste characterisation, which is important when choosing the right recycling technology. Social and economic aspects such as pressure on or obstacles to recycling are also taken into account in the course. The course Resource Recovery 2 focuses on giving the student an insight into where the research front lies in the field, as well as future techniques and opportunities for improved recycling, The ethical aspects related to recycling are also addressed. How companies and society should design products and processes and services and business models to promote a development from linear economy to a circular economy are main components of the course Circular Economy. Life Cycle Assessment is a methods course that focuses on the LCA method, its applications and its limitations. The course Theory of Science and Research Methodology is given during the first term; in this course, students gain increased knowledge and understanding of the research process and about quantitative as well as qualitative research methodologies in order to be able to apply this knowledge in project work and be well prepared for the final degree project.

Term 2
It is during this term that there is first an element of specialisation within industrial biotechnology. During this term, there are increased laboratory components and major project work is introduced in which more complex issues are handled. The focus deepens the student's knowledge of biological processes in energy and recycling, i.e. conversion of waste and other residual materials into biofuels, new materials, or food. This block of courses is based primarily on the courses *Resource Recovery 1, Resource Recovery 2, Life Cycle Assessment, and Circular Economy.*

• Industrial Biotechnology 7.5 ECTS credits
• Biotechnology Processes and Applications, 7.5 ECTS credits
• Bioprocess Design, 15 ECTS credits

The block of courses with the courses *Industrial Biotechnology, Biotechnology Processes and Applications, and Bioprocess Technology* deals with bacteria, yeast, and microfungi with a focus on resource recovery to produce important products such as lactic acid, ethanol, biogas, textiles, biopolymers, food, or feed. Developing process concepts as well as designing processes with different software is an important part of being able to provide tools to the students in order to develop new ideas in the subject and evaluate the subject technically, economically, and environmentally. The students also acquire skills in central cell biological, biochemical, and microbiological methods.

Courses year 2 (terms three and four)
Terms 3 and 4 consists only of a degree project, divided into two courses Degree project 1, 30 ECTS credits and Degree project 2, 30 ECTS credits. In Degree project 2, the research project is further specialised. During year 2, there is an opportunity for students to exchange the course Degree project2 for courses comprising of 30 ECTS credits. The intention is to facilitate various forms of internationalisation, such as exchange studies. The courses are to be linked to the objectives of the programme.

Prerequisites
Degree of Bachelor of Science or Degree of Bachelor of Science in Engineering, 180 ECTS credits, specialising in mechanical engineering, industrial economics, energy engineering, chemical engineering, biotechnology, road and water technology, textile engineering, or construction engineering. Or a Bachelor's degree in physics or chemistry. To study this specialisation, you need prior knowledge of chemistry. In addition, knowledge of English equivalent to English 6 is required.

Admission Requirements

Degree of Bachelor of Science or Degree of Bachelor of Science in Engineering, 180 ECTS credits, specialising in mechanical engineering, industrial economics, energy engineering, chemical engineering, biotechnology, road and water technology, textile engineering, or construction engineering. Or a Bachelor's degree in physics or chemistry. To study this specialisation, you need prior knowledge of chemistry. In addition, proficiency in English equivalent to Swedish upper secondary course English 6 is required.

Degree

After completing the educational programme corresponding to the requirements in this programme syllabus, the student can, upon application to the university, receive this degree:

Degree of Master of Science (Two Years) with a major in Resource Recovery – specialisation Industrial Biotechnology

The diploma is bilingual (Swedish/English). Together with the diploma, you receive a Diploma Supplement (English). A Diploma Supplement is an appendix describing the place of the awarded degree within the Swedish education system. Diplomas are issued upon application via a form. More information can be found on the university's website.

Degree certificates are issued upon application in Ladok for students. More information is available at www.hb.se.

Student Influence and Evaluation

All courses within the programme are evaluated (see the university's policy for course evaluation). The Programme Coordinator is responsible for ensuring that students' views on the education are systematically and regularly collected. The Programme Coordinator together with the Dean of Faculty, is responsible for ensuring that the programme is evaluated annually with the participation of the students. The evaluation is documented in writing and returned to the students.

Miscellaneous

This syllabus is a translation from the Swedish written original.

The language of instruction is English.