Reg. no HNT 2024/805
Approved 12 December 2024

Programme Syllabus

Master of Science in Chemical Engineering

Programme code:	TACKT
Programme title:	Master of Science in Chemical Engineering *Civilingenjör Kemiteknik*
Credits:	300
Programme approval:	The programme syllabus was approved by the Faculty Board of Health, Science and Technology on 12 December 2024, effective from the autumn semester of 2025.
Language of instruction:	Swedish and English
Education cycle:	Second (Master's)
Degree type:	Professional
Degree title:	Master of Science in Chemical Engineering
Entry requirements:	General admission requirements and Mathematics 4/E, Physics 2 and Chemistry 1

General information

Chemical engineering is about applying interdisciplinary approaches to the design of large-scale processes and systems, as well as materials development. The combination of molecular and technical perspectives and development of experimental skills are important components of a study programme in chemical engineering.

Access to chemical engineering expertise is essential for society's transition to sustainable manufacturing processes based on renewable raw materials and energy.

The Master of Science in Chemical Engineering at Karlstad University applies a holistic approach to how chemical engineering can contribute to sustainable social development and focuses on designing sustainable processes for both the business sector and the public sector.

At the Master's level, there are two alternative specialisations: the forest industry and pharmaceutical analysis.

Programme outcomes

The Higher Education Ordinance, System of Qualifications, specifies the outcomes required for certain degrees. The outcomes for a Degree of Master of Science in Chemical Engineering are as follows:

General outcomes
For a Degree of Master of Science in Engineering, the student shall demonstrate the knowledge and skills required to work autonomously as a graduate engineer.

Knowledge and understanding

For a Degree of Master of Science in Engineering the student shall

- demonstrate knowledge of the disciplinary foundation of and proven experience in his or her chosen field of technology as well as insight into current research and development work, and
- demonstrate both broad knowledge of his or her chosen field of technology, including knowledge of mathematics and the natural sciences, as well as a considerable degree of specialised knowledge in certain areas of the field.

Competence and skills

For a Degree of Master of Science in Engineering the student shall

- demonstrate the ability to identify, formulate and deal with complex issues autonomously and critically and with a holistic approach and also to participate in research and development work and so contribute to the formation of knowledge
- demonstrate the ability to create, analyse and critically evaluate various technological solutions
- demonstrate the ability to plan and use appropriate methods to undertake advanced tasks within predetermined parameters
- demonstrate the ability to integrate knowledge critically and systematically as well as the ability to model, simulate, predict and evaluate sequences of events even with limited information
- demonstrate the ability to develop and design products, processes and systems while taking into account the circumstances and needs of individuals and the targets for economically, socially and ecologically sustainable development set by the community
- demonstrate the capacity for teamwork and collaboration with various constellations, and
- demonstrate the ability in speech and writing both nationally and internationally to clearly report and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences.

Judgement and approach

For a Degree of Master of Science in Engineering the student shall

- demonstrate the ability to make assessments informed by relevant disciplinary, social and ethical aspects as well as awareness of ethical aspects of research and development work
- demonstrate insight into the possibilities and limitations of technology, its role in society and the responsibility of the individual for how it is used, including both social

and economic aspects and also environmental and occupational health and safety considerations, and
- demonstrate the ability to identify the need for further knowledge and undertake ongoing development of his or her skills.

Independent project (degree project)

For a Degree of Master of Science in Engineering the student shall

- within the parameters of course requirements complete an independent project (degree project) of at least 30 credits.

In addition to the learning outcomes specified in the System of Qualifications outlined in the Higher Education Ordinance, the Master of Science in Chemical Engineering at Karlstad University includes the following specific outcomes:

Knowledge and understanding

For a Degree of Master of Science in Engineering the student shall

- demonstrate in-depth knowledge of the principles of chemistry and how these are applied in chemical engineering, and
- demonstrate sound knowledge of the different dimensions of sustainable development.

Competence and skills

For a Degree of Master of Science in Engineering the student shall

- demonstrate the ability to connect the principles and proven experience of chemical engineering and chemistry with sustainability criteria in the design of new products, processes and systems.

Judgement and approach

For a Degree of Master of Science in Engineering the student shall

- demonstrate the ability to present arguments and adopt a proactive approach when the requirements for designing a new product or process are partially conflicting.

Programme structure

The programme is divided into two educational cycles: **bachelor's level** (180 credits) and **master's level** (120 credits). The programme comprises both elective and optional courses. It is recommended that students confer with the programme coordinator when choosing such courses, since it will affect what courses will follow as well as the nature of the degree. There are opportunities for studying abroad.

Studies at the **bachelor's level** comprise six semesters (180 credits) and include basic chemistry and chemical engineering, as well as courses in mathematics and technology, and components from the humanities and social sciences. Students are trained in experimental work and project work, which is communicated in writing and orally. The courses aim to provide students with knowledge in basic chemistry and chemical engineering, and prepare them for studies at master's level. Students can opt to complete a Degree of Bachelor of Science with chemical engineering as the main field of study.

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Studies at the **master's level** comprise four semesters (120 credits) of specialised courses in chemical engineering of at least 90 credits, including a degree project of 30 credits.

At the master's level, there are two alternative specialisations: the forest industry and pharmaceutical analysis.

Contact with the wider community is established early on in the programme and maintained throughout in order to let students come into contact with possible future careers, as well as to allow for collaboration in the courses. At the master's level, there is also close collaboration with researchers in chemical engineering.

Internationalisation

Karlstad University wants to promote collaboration and exchange with other universities. In line with this, Karlstad University has partnerships with many other universities in Sweden and abroad, as well as an organisation in place to support students who want to make use of this opportunity. Students are therefore encouraged to complete part of the programme at a university abroad.

Preferably, students should undertake studies abroad during semester 8, 9 or 10.

Programme curriculum

Bachelor's level: Courses in chemical engineering, 67.5 credits, including basic chemical engineering, applied thermodynamics, fluid mechanics, chemical reaction engineering, materials and environment, heat and mass transfer, separation processes, and a project in process engineering.

Courses in chemistry, 45 credits, including basic chemistry, chemical calculations, organic chemistry, biochemistry, physical chemistry and analytical chemistry.

Courses in mathematics, 37.5 credits, including basic mathematics, analysis and geometry, linear algebra, calculus in several variables, and stochastic methods.

Courses in another technical field, 22.5 credits, and basic business administration for engineers, 7.5 credits.

Students can also opt to replace courses totalling 15 credits in semester 6 with a bachelor's essay in chemical engineering for a Degree of Bachelor of Science.

Master's level: Mandatory master's courses in chemical engineering, 30 credits, forest bioeconomy – processes, energy and products, as well as pulp and paper technology, elective master's courses in chemistry or chemical engineering or broadening courses, 60 credits, and a degree project for a Master of Science in Chemical Engineering, 30 credits.

Recommended elective courses for a specialisation in the forest industry are bio-based materials and products, green chemistry and chemical engineering, pulp and paper technology II, applied CFD in fluid mechanics and heat transfer, applied heat and mass transfer, green entrepreneurship, and research training in chemistry and chemical engineering.

Recommended elective courses for a specialisation in pharmaceutical analysis are physical chemistry of macromolecules D, surfaces, interfaces and colloids D, scientific writing and theory of science, advanced analytical chromatography - theory and practice D, pharmaceuticals – chemical analysis in projects D, and molecular biotechnology with applications D.

Credit transfer

Students have the right to transfer credits from previously completed university courses in Sweden or abroad. Credit transfer is subject to approval according to the current regulations.

Additional information

The local regulations for first and second cycle education at Karlstad University stipulate the obligations and rights of students and staff.

This programme syllabus will replace the previous version approved 1 December 2022, reg. no: HNT 2022/658.