



HÖGSKOLAN I GÄVLE

PROGRAMME SYLLABUS

FIRST CYCLE

STUDY PROGRAMME IN MECHANICAL
ENGINEERING, CO-OP
Programme Code: TGMCY

Established by the Faculty Board 2011-03-23

Programme Syllabus

**Study Programme in Mechanical
Engineering, Co-op, 180 HE credits**
(Maskiningenjör, Co-op, 180 högskolepoäng)

This programme syllabus applies to students admitted to the autumn semester of 2011 or later.

**STUDY PROGRAMME IN MECHANICAL ENGINEERING, CO-OP
at Högskolan i Gävle**

1 General Arrangement

The Study Programme in Mechanical Engineering, Co-op combines courses into a Bachelor of Science in Engineering of 180 HE credits. The progression of the education occurs in the main field of mechanical engineering, and contains the basics in energy technology and industrial management. The programme contains one introduction year, one broadening year with continuation courses and one year of advanced courses. During the year of advanced courses, half of the programme length consists of projects and a degree project. The projects are carried out in close cooperation with companies.

The programme is based on problem-based learning with project work as the most common working method. In the projects, the students will function in the different roles of a project group, and are therefore trained to cooperate in a project and also between different project groups. Elements of group dynamics give the students understanding of how conflicts may arise and are handled in a project group. Planning, management and documentation of projects are included as a natural part of the different projects. The students also obtain an orientation in different tools that are used for planning and control of projects. The students may use specific project rooms with Internet-connected computers throughout the programme.

The programme may be studied as a traditional engineering education or as Cooperative Education, Co-op. Co-op means that students alternate studies and work during scheduled work periods. A work period of 10 weeks is included in each academic year. A total of four work periods during the four years of studies are included. The education fulfils the entry requirements for continued studies on the master's programme (one year and two years).

2 Expected Learning Outcomes

2.1 Expected Learning Outcomes for First-cycle Programmes According to the Higher Education Act, Chapter 1, Section 8, and Qualification Descriptor According to the Higher Education Ordinance, Appendix 2

2.1.1 Expected Learning Outcomes for First-cycle Programmes According to the Higher Education Act, Chapter 1, Section 8

First-cycle studies shall essentially expand upon the knowledge that the pupils acquire on national or specially designed programmes in upper-secondary school, or equivalent knowledge. The government may, however, grant exemptions regarding programmes in fine, applied and performing arts.

First-cycle studies should develop the students

- ability to make independent and critical assessments

- ability to independently discern, formulate and solve problems, and
- preparedness to address changes in the working life.

Within the field of the education, the students should, in addition to knowledge and skills, develop the ability to

- search and evaluate knowledge on an academic level
- follow the knowledge development, and
- exchange knowledge also with individuals without expertise in the area.

2.1.2 Qualification Descriptor According to the Higher Education Ordinance, Appendix 2

Bachelor of Science in Engineering

Extent

A Bachelor of Science in Engineering is achieved when the student has successfully completed required courses of 180 HE credits.

Expected Learning Outcomes

For a Bachelor of Science in Engineering, the student should demonstrate the knowledge and abilities required to work independently as an engineer.

Knowledge and Understanding

For a Bachelor of Science in Engineering, the student should

- demonstrate knowledge of the disciplinary foundation of the chosen technological field and its best practice, and knowledge of current research and development,
- demonstrate a broad expertise in the chosen field of technology, and relevant knowledge in mathematics and natural sciences.

Skills and Abilities

For a Bachelor of Science in Engineering, the student should

- demonstrate the ability to independently and creatively identify, formulate and handle issues with an overall view, and analyse and evaluate different technical solutions
- demonstrate the ability to plan and with adequate methods, carry out assignments within given frames
- demonstrate the ability to critically and systematically use knowledge, and to model, simulate, predict and evaluate developments based on relevant information
- demonstrate the ability to design and handle products, processes and systems with consideration to the conditions and needs of people and the target of society for economic, social and ecological sustainable development,
- demonstrate the ability to work in teams and cooperate in groups with different compositions,
- demonstrate the ability to account for and discuss information, problems and solutions in dialogue with different groups, orally and in writing.

Judgement and Approach

For a Bachelor of Science in Engineering, the student should

- demonstrate the ability to make assessments with consideration to relevant scientific, social and ethical aspects
- demonstrate an understanding of the possibilities and limitations of technology, its role in society and people's responsibility for its use, including social and economic aspects and environmental and working environmental aspects, and
- demonstrate the ability to identify the own need of additional knowledge and to continuously develop the own skills.

Thesis (degree project)

For a Bachelor of Science in Engineering, the student must have successfully completed an individual assignment (degree project) of at least 15 HE credits, within the framework of the required courses.

Other

For a Bachelor of Science in Engineering, the specific requirements decided by each higher education institution within the framework of the requirements in this qualification descriptor should also apply.

2.2 Specific Expected Learning Outcomes for the Programme

The purpose of the education is to provide good knowledge and skills in developing, designing and producing products using modern computer technology, on a scholarly basis.

Knowledge and Understanding

For a Bachelor of Science in Engineering, the student should

- understand mechanical equilibrium problems
- understand and create technical drawings using CAD systems
- understand and analyse material-technical problems
- be able to present results both orally and in writing
- be able to plan a project based on given specifications
- be able to define and explain central concepts concerning project work and project management, and be able to account for the different roles of a project group
- understand the different stages in a project process, and how these interact over time
- understand the relationship between planning, organisation and follow-up of a project
- be able to interact with other members of a project group and actively contribute to the work of the group.

Skills and Abilities

For a Bachelor of Science in Engineering, the student should

- with mathematical knowledge in linear algebra and calculus, carry out engineering calculations
- be able to carry out calculations for mechanical equilibrium problems

- be able to use CAD systems for production of basic and account for different manufacturing processes, and use these in practice
- understand and calculate basic statically determinate and indeterminate solid mechanics problems
- be able to use common machine elements in own developed designs
- be able to use methods for systematic product development of composite models and present drawings for these
- be able to account for and analyse the process and effects of cutting machining
- be able to apply the technical knowledge and environmental aspects in exercises, project work and degree projects
- demonstrate the ability to make assessments of the suitability of different tools for control and quality assurance of a project
- as the project manager, be able to delegate responsibilities to other project members and be able to discover and handle conflicts that may arise in a project group
- be able to realise the importance of the different roles in a project group
- demonstrate the ability to assess the status of a project and its possibilities of target achievement
- observe the group dynamics and act when problems arise
- develop products and proposals for designs, based on technical problems considering functionality, space allowances, resource utilisation, environment, economics and ergonomics
- carry out construction work considering the strength of materials, materials selection, manufacturability, environmental consideration and sustainable development
- design and dimension a production system in cutting machining
- methodically identify and solve problems including information gathering, analysis, design of alternative solutions, evaluation and implementation, and present results both orally and in writing
- assess how energy, electricity and automatic control technology and industrial management influence a production system.

Judgement and Approach

For a Bachelor of Science in Engineering, the student should

- demonstrate the ability to formulate search questions and seek information in relevant sources
- demonstrate the ability to interpret and write references
- be able to account for the difference between scientific material and other types of material
- be able to follow the knowledge development in the own subject area
- be familiar with the forms of scholarly communication and publication
- demonstrate the ability to review, analyse and evaluate both the search process and search results
- demonstrate the ability to present criteria for assessment of sources of information and application of these.

3 Description of the Programme

3.1 Main Field of Study and Programme-specific Courses

3.1.1 Main Field of Study Mechanical Engineering

In the programme, mechanical engineering constitutes the technical main field of study. The basics of mechanical engineering are studied during the initial project semester and in the course Material Science and Manufacturing Processes. During year two, basic courses in machine elements and solid mechanics within mechanical engineering are studied. During year two, the project course Concurrent Engineering is studied, where previously studied parts are applied through the project groups being assigned themes for the projects, which are received from companies. During the third year, the studies in mechanical engineering are advanced with the finite element method, and also the course Manufacturing and Production Systems. The third project course Industrial Systems is also carried out then, in collaboration with companies.

The programme ends with a degree project. The degree project may be carried out in concentrated form at the end of the education or begin early in last the semester. In the latter case, a continuation and connection may be made to the project course Industrial Systems. Through the degree project, knowledge acquired during previous studies should be applied, broadened and advanced. Through the degree project, the student should demonstrate that the learning outcomes for first-cycle programmes stated in the Higher Education Act, the learning outcomes for Bachelor of Science in Engineering stated in the Higher Education Ordinance and the specific learning outcomes stated in this programme syllabus have been fulfilled.

3.1.2 Programme-specific Courses

Within the programme, three major project courses with clear progression are carried out. During the initial semester of the first year, the project course Product Development and Production Systems is studied. Integrated in this course is basic project methodology, presentation and communication techniques and an introduction to the main field of mechanical engineering. Study visits are made at industrial companies. During semester four (for Co-op, semester six) the project course Concurrent Engineering is carried out, where the themes for the projects are retrieved from companies in the region, and the studies are carried out in close cooperation and often on location in a business environment. The themes that are chosen provide the basis for both independent work in the project groups and for presentations at seminars and discussions. During semester five (for Co-op, semester seven) the project course Industrial Systems is carried out, where the project assignments are retrieved from companies, and the project group work is characterised by a high degree of independence. Supervision is given both by teachers from the higher education institution and from the concerned companies. The projects are presented at seminars, where the concerned companies are represented.

3.2 Teaching and Examination

3.2.1 Teaching

The educational view is based on the fact that all learning is an active, dynamic process which takes place in collaboration between teachers and students. All teaching and supervision should be based on the student taking own responsibility for the studies and for active knowledge acquisition. The learning implies that the theoretical and practical teaching in the courses should be integrated as useful knowledge and skills in each individual. In that way, the student is given the opportunity of personal development, which is of great importance for the future profession and a lifelong learning. The student should also acquire preparedness to address changes and the ability to review the own knowledge to be able to actively participate in the development and evaluation of the professional domain. Different teaching and working methods should teach the student to actively search for knowledge, critical thinking, reflection and oral and written proficiencies and in using academic literature.

In the education, the ability to work in project form is practised. Through an initial joint semester, the students acquire necessary knowledge about the implementation of a project. The students will function in different roles and as project managers. The different projects are carried out with clear progression. Each project has clearly stated targets for what knowledge the student should acquire. Through examination of the projects, the level of knowledge is tested, both in the groups and individually. In the later part of the education, an increased part of problem-based learning is allowed within certain frames. The scheduled teaching is given as lectures, teaching sessions, laboratory sessions, project work and seminars. A part of the teaching is carried out as group work. Attendance is compulsory at certain teaching parts. Apart from the scheduled teaching, self-studies occur. The teaching is mainly given in Swedish, but lectures in English and English course literature may occur.

The progression of the education occurs through a progressive specialisation in the chosen field of technology, through in-depth subject studies, development of the scholarly approach and through development of the engineering working method. Within the technical main field of study, progression occurs through a broadening of the knowledge in the project courses and other courses in mechanical engineering. The engineer support courses provide additional broadening.

3.2.2 Examination

In the programme courses, varying examination formats are applied, such as written and oral tests, seminar presentations, take-home examinations and written/project assignments presented orally and in writing.

3.3 Cooperative Education, Co-op

The programme may be read as a traditional higher education resulting in a Bachelor of Arts or a Bachelor of Science in Engineering after three years, or as Cooperative Education (Co-op), which takes four years. Co-op implies that the student alternates studies and work during the planned work periods. The co-op positions are limited and the higher education institution cannot guarantee a position at any of the companies linked to the higher education institution, and the company decides if the

student's application and interview lead to employment during the education. Students who do not receive a Co-op position will study for three years instead for four. The first semester gives further information about what Co-op implies and how to apply for the Co-op positions. The Co-op students' experiences will be utilised in several of the programme courses.

Each work period should be reported in a written report and an oral presentation. The first work period must be preceded by studies of at least 45 HE credits within the programme at Högskolan i Gävle, of which at least 30 HE credits must be passed. In order to begin the second, third and fourth work period, courses within the programme of at least 45 HE credits, 60 HE credits and 75 HE credits must be passed.

3.4 Student Influence

There is a council for educational affairs linked to the programme, which consists of representatives from the working life, teachers and students. The council for educational affairs is advisory. Gefle Student Union appoints student representatives. There are student representatives in the board of governors, the faculty boards and in the department boards.

3.5 Internationalisation

The higher education institution participates in the placement programmes IAESTE and WITEC. These programmes are administrated by the International Office at HiG. A collaboration is also established within the SIDA-supported programme MFS (Mines Field Study).

3.6 Sustainable Development - Technology and Society

An important starting point in the education is that an engineer must be able to view new technology from a social perspective. An engineer must have knowledge about and skills in managing products, processes and working environments with consideration to people's conditions and needs and to the targets of society concerning social relations, resource management, environment and economy. After the education, the student should be able to take environmental requirements in problem-solving and product development into account, and have the ability to promote environmentally adapted technology. Working methods exercising these abilities are therefore important elements in the education.

4 Courses in the Programme

The students have guaranteed admission to the courses within the programme. Course applications for the following semester must be submitted. Changes in the order of courses may be made in consultation with students in the programme. Changes in the programme courses are determined by the Faculty Board. Change of period when the course given is determined on department level. Alternative course choices may be made in consultation with the faculty programme director, provided that the expected learning outcomes for the programme are fulfilled.

F = First cycle.

Study path according to the three-year model

Year 1

Period	Course Name	HE credits	Level	Main Field of Study
1:1	Project Methodology	5	F	Industrial Management
1:2	Management Accounting and Control	5	F	Industrial Management
1:1-1:2	Product Development and Production Systems	20	F	Mechanical Engineering
1:3	Linear Algebra for Engineers	7.5	F	Mathematics
1:3	Fundamentals of Logistics	7.5	F	Industrial Management
1:4	Calculus	7.5	F	Mathematics
1:4	Material Science and Manufacturing Processes	7.5	F	Mechanical Engineering

Year 2

Period	Course Name	HE credits	Level	Main Field of Study
2:1	Thermodynamic and Fluid Mechanics	7.5	F	Energy Technology
2:1	Manufacturing Logistics	7.5	F	Industrial Management
2:2	Machine Elements	7.5	F	Mechanical Engineering
2:2	Engineering Mechanics	7.5	F	Mechanical Engineering
2:3-4	Concurrent Engineering	15	F	Mechanical Engineering
2:3	Solid Mechanics for Engineers	7.5	F	Mechanical Engineering
2:4	Maintenance Techniques (Elective Course)	7.5	F	Mechanical Engineering
2:4	Control Technology with Digital Technology (Elective Course)	7.5	F	Electronics

Year 3

Period	Course Name	HE credits	Level	Main Field of Study
3:1	Mathematics for Engineers, Cont. Course	7.5	F	Mathematics
3:1	Leadership 1 - Basic Concepts	7.5	F	Business Administration
3:2	Industrial Systems	15	F	Mechanical Engineering
3:3	Manufacturing and Production Systems	15	F	Mechanical Engineering

3:4	Degree Project	15	F	Mechanical Engineering
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Study path according to the Co-op model

Year 1

Period	Course Name	HE credits	Level	Main Field of Study
1:1	Project Methodology	5	F	Industrial Management
1:2	Management Accounting and Control	5	F	Industrial Management
1:1-1:2	Product Development and Production Systems	20	F	Mechanical Engineering
1:3	Linear Algebra for Engineers	7.5	F	Mathematics
1:3	Fundamentals of Logistics	7.5	F	Industrial Management
1:4	Work Period 10 weeks			

Year 2

Period	Course Name	HE credits	Level	Main Field of Study
2:1	Thermodynamic and Fluid Mechanics	7.5	F	Energy Technology
2:1	Manufacturing Logistics	7.5	F	Industrial Management
2:2	Machine Elements	7.5	F	Mechanical Engineering
2:2	Engineering Mechanics	7.5	F	Mechanical Engineering
2:3	Work Period 10 weeks			
2:4	Calculus	7.5	F	Mathematics
2:4	Material Science and Manufacturing Processes	7.5	F	Mechanical Engineering

Year 3

Period	Course Name	HE credits	Level	Main Field of Study
3:1	Mathematics for Engineers, Cont. Course	7.5	F	Mathematics
3:1	Leadership 1 - Basic Concepts	7.5	F	Business Administration
3:2	Work Period 10 weeks			
3:3-4	Concurrent Engineering	15	F	Mechanical Engineering
3:3	Solid Mechanics for Engineers	7.5	F	Mechanical Engineering

3:4	Maintenance Techniques (Elective Course)	7.5	F	Mechanical Engineering
3:4	Control Technology with Digital Technology (Elective Course)	7.5	F	Electronics

Year 4

Period	Course Name	HE credits	Level	Main Field of Study
3:1	Work Period 10 weeks			
3:2	Industrial Systems	15	F	Mechanical Engineering
3:3	Manufacturing and Production Systems	15	F	Mechanical Engineering
3:4	Degree Project	15	F	Mechanical Engineering

5 Entry Requirements

General entry requirements, specific entry requirements 8 and the following specific entry requirements:

Subject	Course
Mathematics	Ma D
Physics	Fy B
Chemistry	Ke A

The grade for each of the above subjects should be at least Pass.

6 Grades

Grades should be given for programme courses, see current course syllabus.

7 Examination Regulations

7.1 Title of Qualification

Bachelor of Science in Engineering
Högskoleingenjörsexamen

7.2 Qualification Criteria

To receive a certificate for a Bachelor of Science in Engineering in the technical main field of mechanical engineering, the student must have successfully completed courses of 180 HE credits. The higher education qualification should include at least 22.5 HE credits in mathematics, at least 90 HE credits with a progressive specialisation in the technical main field of mechanical engineering, including a degree project of 15 HE credits and 30 HE credits in other technical courses. Remaining credits are used for broadening and/or advanced studies in the technical main field of study, other technical courses and in the area of engineering support courses.

To fulfil the degree requirements for a Bachelor of Science, students who follow the Study Programme in Mechanical Engineering must supplement their studies with e.g. studies in mathematics. An individual study plan may be established by the faculty programme director.

7.3 Degree Certificates

Students who fulfil the requirements for a higher education qualification should receive a degree certificate on request. Each degree certificate must be followed by a diploma supplement that describes the education and its place in the education system (the Higher Education Ordinance, chapter 6, section 15). The appendix is called Diploma Supplement. Diploma Supplement should facilitate recognition and credit transfer of a Swedish higher education qualification in employment and continued studies abroad, but also in Sweden.

8 Further Instructions

Interim Regulations.

Students admitted to the earlier years of the Study Programme in Mechanical Engineering follow the programme syllabus for that year.

For students admitted to the later part of the programme and for students who have had approved leave from studies, a specific study plan is established, if necessary, by the faculty programme director in consultation with the director of studies.