HÖGSKOLAN I GÄVLE

HÖGSKOLAN I GÄVLE

PROGRAMME SYLLABUS

FIRST CYCLE

STUDY PROGRAMME IN ELECTRICAL ENGINEERING
Programme Code: TGELY
Established by the Board of Science and Technology 2006-09-21
Revised by the Board of Science and Technology 2009-05-07

Programme Syllabus

Study Programme in Electrical Engineering, 180 HE credits

(Elektronikingenjörsprogrammet, 180 hp)

This programme syllabus applies to students admitted to the autumn semester of 2010 or later.

STUDY PROGRAMME IN ELECTRICAL ENGINEERING
at Högskolan i Gävle

1 General Arrangement

Study Programme in Electrical Engineering combines courses into a Bachelor of Science in Engineering of 180 HE credits. The education provides a broad education in computer science with a specialisation in electronics. 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.

Courses and project are alternated in the education. The courses are given both as project support and engineering support courses. In parallel with the projects, courses are given which are applied in these. Engineering support courses provide the engineering width of knowledge used in the education and in the future working life as an engineer.

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 should essentially expand upon the knowledge that 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
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, and
- 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, and
- 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 Learning Outcomes of the Programme

Knowledge and Understanding
For a Bachelor of Science in Engineering, the student should
- understand the structure and working methods of the computer
- be able to account for the structure, components and functions of computer systems
- be able to practically apply programming skills in a common programming language by carrying out programming projects, independently and in groups
- be able to demonstrate an understanding of concepts in electronics, concerning components and circuits
- have acquired knowledge of electronic measurement to be able to independently make measurements on objects and be able to analyse the results of these measurements
- be able to understand designs and programming of systems in automatic control
- have a comprehensive view of how a microcomputer system or another digital system is constructed, and program these using assembler, high-level and hardware description languages
- be familiar with concepts, modulation techniques and coding principles used in electronic communication systems
- be aware of the problems of electronic communication and how possible problems are eliminated or minimised
- demonstrate an understanding of how different systems' mathematical transfer functions are developed and be able to account for how these represent the system
- be able to define and explain central concepts concerning project work and project management
- be able to account for the different roles in a project group
- demonstrate an understanding of the different stages of a project process and how these interact over time
- demonstrate an understanding of the relationship between planning, organisation and follow-up of a project
- demonstrate an understanding of the interplay between different parts of society and different cultures

Skills and Abilities
For a Bachelor of Science in Engineering, the student should

- have the ability to apply filtering of analogue and digital signals, through construction and design
- have knowledge of control engineering concepts and be able to analyse and optimise a system
- be able to interact with other members in a project group and actively contribute to the work of the group
- be able to discover and handle conflicts that may arise in a project group
- be able to plan a project based on given specifications
- as a project manager, be able to delegate responsibilities to other project members
- be able to realise the importance of the different roles in a project group
- be able to assess the status of a project and the possibility to achieve goals
- demonstrate the ability to make assessments of the suitability of different tools for control and quality assurance of a project
- be observant of the group dynamics and act when problems arise
- be able to apply technical and other knowledge to analyse, formulate and solve problems and present this knowledge to different target groups
- be able to independently acquire knowledge in the area of electronics and other fields, and understand the interplay between different subject areas
- be able to have a dialogue with people in the field of technology and close fields, individually or in groups

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

3.1.1 Technical Main Field of Study Electronics

In the programme, electronics constitutes the technical main field of study. The basics in the technical main field of study are studied during the initial project semester and through basic courses during the following semester. During year two, additional basic courses and advanced courses in the technical main field of study are given. During the project course in year two, previously studied parts are applied through the project groups receiving themes for the projects, mainly from companies, and the studies are carried out in close cooperation with companies and in company environments in so far as applicable. During the third year, the studies in the technical main field of study and the third project course are developed, and the degree project is carried out.

3.1.2 Project Courses

Within the programme, three major project courses with clear progression are carried out. During the initial semester of the first year, the courses Project Methodology and Management Accounting and Control are studied - Industrial Management and Environmental Issues, in parallel with the project course Computers and Software Engineering. These courses are integrated with emphasis on basic project methodology, presentation and communication techniques and introduction to the chosen technical main field of study. Study visits are made at industrial companies. Semester four includes the project course Low-level Programming and Design. Themes for the projects are mainly received from companies in the region. 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, the project course Applied Electronics is given, 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.

3.1.3 Engineering Support Courses

The engineering support courses consist of courses in linear algebra, calculus, transform theory and discrete mathematics and four optional courses, relevant to the field of engineering. Common for these courses is that they are applied in the project courses.

3.1.4 Degree Project

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 connection and continuation may be made to the project course in the first semester of the third year. 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.

3.2 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 in the programme occurs through a progressive specialisation within the chosen technology field, both through in-depth subject studies and development of the scientific approach, and through improved skills in relation to the engineering profession. Within the technical main field of study, advanced study through a broadening of the knowledge in the project courses is received and through other within computer science. The engineer support courses provide additional broadening.

3.2.2 Examination

Varying examination formats are applied in the programme courses. The format is adapted to the different course requirements on examination formats. Both written and oral tests occur, independent and in groups. The design of the tests, extent and duration are adapted to the expected learning outcomes that are stated in respective course. The examination should also be put in relation to the working life requirements on demonstrated knowledge and skills.

3.3 Placement

Placement at workplaces that provide an insight into and preparation for the future working life is recommended. The placement mainly intends to provide an insight into the working conditions of the future engineer. The higher education institution does not provide placements. Apart from placement, the education includes parts where different forms of cooperation take place with companies in the region. These parts may be carried out both at the higher education institution and at the company.

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, and the faculty programme director is the chairman. There are student representatives in the board of governors, the faculty boards and in the department boards. Gefle Student Union appoints student representatives.

3.5 Internationalisation

Within the programme, international student exchanges are possible. Högskolan i Gävle has exchange agreements with a number of universities and higher education institutions, both within and outside Europe, within the framework of different organisations. It is possible to take courses and carry out degree projects abroad. Appropriate semesters to study abroad are semesters 5 and 6 of the programme.

Assessment and credit transfer of courses studied abroad are made by an appointed responsible at Högskolan i Gävle.
In the same way that students from HiG study abroad, Högskolan i Gävle may receive exchange students from other higher education institutions. As a part of the internationalisation, teachers from other countries may be received for teaching in the subject area. Parts of certain courses are given in English. In year 3, certain courses are given completely in English if there are exchange students in the student groups.

The course literature used in the programme is both in Swedish and English. A specific organisation on HiG administers cases concerning internationalisation, and students may consult them if they are interested in international exchange.

3.6 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 human science and environmental requirements in problem-solving and product development into account, and have the conditions to promote an 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.

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	Computers and Software Engineering	20	F	Computer Science

1:3-1:4	Mathematics for Engineers	15	F	Mathematics
1:3	Electrical Science	7.5	F	Electronics
1:4	Control Technology with Digital Technology	7.5	F	Electronics

Year 2

Period	Course Name	HE credits	Level	Main Field of Study
2:1	Mathematics for Engineers cont.	7.5	F	Mathematics
2:1	Object-oriented Programming I	7.5	F	Computer Science
2:2	Transform Methods and Discrete Mathematics	7.5	F	Mathematics
2:2	Electronics and Measurement Systems	7.5	F	Electronics
2:3-2:4	Low-level Programming and Design	15	F	25 % Computer Science 75 % Electronics
2:3	Network	7.5	F	Computer Science
2:4	Total Quality Management	7.5	F	Industrial Management

Year 3

Period	Course Name	HE credits	Level	Main Field of Study
3:1-3:2	Applied Electronics	15	F	Electronics
3:1	Electronic Communication Technology	7.5	F	Electronics
3:2-3:3	Signals and Systems	15	F	Electronics
3:3	Measurement systems II	7.5	F	Electronics
3:4	Degree Project	15	F	Electronics/ Computer Science

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 are given for the programme courses according to relevant course syllabus.

7 Examination Regulations

7.1 Title of Qualification

Degree of Bachelor of Science in Electrical Engineering
Högskoleingenjörsexamen

Degree of Bachelor of Science
Teknologie kandidatexamen

7.2 Qualification Criteria

To receive a certificate for a Bachelor of Science in Engineering with a major in Electronics, the student must successfully complete courses of 180 HE credits. A higher education qualification should include at least 30 HE credits in mathematics, at least 75 HE credits with progressive specialisation in the technical the main field of study of electronics, 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.

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. The 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 Electrical Engineering follow the programme syllabi 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 by the faculty programme director in consultation with study advisers.