



## Programme syllabus

Faculty of Technology

Mjukvaruteknik, högskoleingenjör, 180 högskolepoäng

Software Engineering Programme, 180 credits

### Level

First Level

### Date of Ratification

Approved 2017-09-08

Revised 2018-02-05 by the Faculty Board within the Faculty of Technology

The programme syllabus is valid from autumn semester 2018

### Prerequisites

General entry requirements and Mathematics 3c, Physics 2 or Mathematics D, Physics B (Field-specific entry requirements 8/A8).

## Description of Programme

The purpose of the program is to prepare students for a professional career as engineers in Software Technology. At the same time, the program will prepare the student for advanced education, i.e. Master degree programs. The education therefore combines basic theoretical courses with more practically applied courses in, for example, programming and project work. Courses that provide basic knowledge include mathematics, physics and computer engineering. More practically applied courses are, for example, operating systems, databases, object-oriented programming, software architectures, etc. The program's special area is Internet of Things (IoT) with an equal focus on how different hardware components can be connected to the Internet as server architectures and server-side technical solutions. A newly trained engineer thus has knowledge that enables him or her to quickly enter the professional role, but also the skills that allow for continuous education throughout the entire professional life. In addition, there are two courses in the field of Technology, Humanities and Society, which are courses in engineering economics and environmental technology.

## Objectives

### Central exam objectives according to the Higher Education Ordinance

#### *Knowledge and understanding*

For a Bachelor of Science in Engineering the student shall have:

- demonstrated knowledge of the disciplinary foundation of the engineering field chosen and best practice in this field as well as awareness of current research and development work, and
- demonstrated broad knowledge in the engineering field chosen and relevant knowledge of mathematics and the natural sciences.

#### *Skills and abilities*

For a Bachelor of Science in Engineering the student shall have:

- demonstrated the ability to identify, formulate and deal with issues autonomously and creatively and to analyse and evaluate technological solutions
- demonstrated the ability to plan and using appropriate methods undertake tasks within predetermined parameters
- demonstrated the ability to use knowledge critically and systematically to model, simulate, predict and evaluate series of events on the basis of relevant information
- demonstrated the ability to design and manage 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
- demonstrated the capacity for teamwork and collaboration with various constellations, and
- demonstrated the ability to present and discuss information, problems and solutions in speech and writing and in dialogue with different audiences.

#### *Judgement and approach*

For a Bachelor of Science in Engineering the student shall have:

- demonstrated the ability to make informed assessments based on relevant disciplinary, social and ethical aspects
- demonstrated insight into the possibilities and limitations of technology, its role in society and the responsibility of the individual for how it is used, including social and economic aspects as well as environmental and occupational health and safety aspects
- demonstrated the ability to identify the need for further knowledge and undertake ongoing development of his or her skills.

#### **Programme specific objectives**

##### *Knowledge and understanding*

After the training, students will have the following knowledge and understanding:

- general knowledge of computers and computer systems
- good knowledge of theories and methods of program development in different programming languages
- good knowledge in core areas such as algorithms, operating systems, databases, networks, etc.
- knowledge and understanding of hardware component programming
- knowledge and understanding of servers, server programming and server-side technical solutions
- general theoretical skills to acquire knowledge of computer science

##### *Skills and abilities*

After the training, students will have the following skills and abilities:

- collect, summarize and present technical material
- specify, design, implement, evaluate and document software systems
- knowledge of project-oriented development work, and
- creativity and initiative

##### *Judgement and approach*

After the training, students will have the following approach and ability to evaluate:

- demonstrate the ability to make judgements based on engineering principles, i.e. assess the relevance, application and accuracy of analyzes and calculations in view of existing assumptions and simplifications in connection with the Computer



view of existing assumptions and simplifications in connection with the Computer Science field

- demonstrate the ability to identify his / her need for additional knowledge within and in connection with the Computer Science field

## Content

### Program Overview

The education covers 180 credits and leads to a Bachelor of Science in Engineering degree. It is a three year programme and each year is divided into two semesters. Each semester consists of two study periods. During a study period, two courses of 7.5 credits are usually read.

The first year contains basic courses in computer engineering, computer science and mathematics. These courses are required as a basis for the courses in years 2 and 3. The second year contains courses based on the knowledge from year 1 and provides a deeper understanding of the subject. Here are many courses in core areas such as object-oriented analysis and design, operating systems, networks, etc. The software for embedded systems is included in the program's IoT focus.

The third year courses focus on the special field of Internet of Things (3 courses) but also include a number of G2F courses that build on and deepen knowledge from years 1 and 2. Year 3 also includes three TMS courses, courses belonging to the field of Technology, Human and Society. The thesis work is done either individually or in groups of two students. The thesis work is usually done on a company where the problem to be solved is a real world problem. The thesis also provides training in planning and implementing a project, as well as the ability to define problems, conduct a survey, analyze and present the results in writing and orally. The thesis work may also involve the student doing a deep study of a certain limited field of technology. The result of the work is compiled in a written report, which is also presented orally to teachers and students.

### Courses in the program

The exact placement of courses in year and study period may vary slightly from year to year. The courses in the program can also be exchanged for corresponding courses within the program's direction, in agreement with the program manager. In exchange for courses, the program manager checks that the program's goals and requirements are still met. The pre-requisites for courses as well as the local rules for the Linnaeus University degree must always be met.

The programme courses are divided into levels G1N, G1F, G2E, and G2F. Courses on G2 level usually have courses on level G1 as a prerequisite.

- G1N undergraduate level, has only secondary school prerequisites
- G1F undergraduate level, have less than 60 credits in course prerequisites
- G2F undergraduate level, have at least 60 credits in course prerequisites
- G2E undergraduate level, have at least 60 credits in course prerequisites

The final thesis is on level G2E and is normally done during the spring semester in the third year.

### Courses included:

#### Year 1:

- Basic Mathematics for Engineers, G1N, 7.5 credits. Introductory course in mathematics dealing with algebraic expressions, equations, trigonometry, exponential functions, complex numbers.
- Software engineering - introduction and project, G1N, 7.5 credits. Introduction to Computer Science, the engineering profession, and working in projects.
- Linear Algebra for Engineers, G1N, 7.5 credits. The course deals with vectors in 2D and 3D, solving linear systems of equations, matrices, linear transformations, and Eigen values.
- Problem Solving and Programming, G1N, 7.5 credits. Introductory course in object-oriented programming in Java with an equal focus on object-oriented concepts and practical programming skills.



- Software Technology, G1F, 7.5 credits. The course covers basic principles and techniques for software development. The course focuses on tools that can be used in development of software to support the modeling, configuration management and testing.
- Programming and Data Structures, G1F, 7.5 credits. Continuation course on object-oriented programming (Java). Provides a more advanced view of object-oriented modeling involving concepts such as inheritance and polymorphism. Provides also an introduction to algorithms and data structures. Graphical user interfaces are also included.
- Discrete Mathematics, G1F, 7.5 credits. The course will introduce the basic concepts and methods of discrete mathematics, especially those that are important in computer science.
- Project course in Computer Science, G1F, 7.5 credits. Continuation course improving both programming and team working skill. Provides an introduction to the software development process and related tools.

#### Year 2:

- Object-oriented Analysis and Design, G1F, 7.5 credits. Object-oriented analysis and design focusing on frequently occurring design problems and practical examples.
- Computer Technology, G1F, 7.5 credits. Provides an understanding of the hardware environment in which a software is executed in. Also deals with machine architectures and low-level programming.
- Electricity and Magnetism, G1N, 7.5 credits. Basic course in electricity and magnetism.
- Operating Systems, G1F, 7.5 credits. Provides an overview of the structure of operating systems and the resources that it manages.
- Software Engineering - Design, G1F, 15 credits. A project-oriented course teaching advanced concepts in software design.
- Computer Networks - An introduction, G1F, 7.5 credits. Provides theoretical knowledge about computer communication and computer networks, and practical skills in network related programming.
- Software for Embedded Systems, G1F, 7.5 credits. The course deals with the design process of software for embedded systems.

#### Year 3:

- Embedded Systems Dependability, G2F, 7.5 credits. Continuation course that provides a deeper knowledge about embedded systems and IoT.
- Embedded Systems Project, G2F, 7.5 credits. Project course where students work in a group on a project about embedded systems and IoT.
- Database Theory, G2F, 7.5 credits. The course provides a technical and conceptual view of database systems by studying database models, relational algebras and storage structures.
- Industrial Economics and Organization for Engineers, G1N, 5 credits. The aim of the course is to give the student an understanding of basic economic concepts, as well as to understand the technical consequences of different economic decisions. The course is part of the field of Technology, Human and Society (TMS).
- Technical Communication for Engineers, G1N, 5 credits. The aim of the course is to provide the student with the necessary skills for written and oral communication situations. The course is part of the field of Technology, Human and Society (TMS).
- Sustainable Development for Engineers, G1N, 5 credits. The aim of the course is to give the student the necessary understanding of sustainable development from ecological, social and economic aspects, as well as from a global, local and industrial perspective. The course is part of the field of Technology, Human and Society (TMS).



Society (TMS).

- Engineering Economics, G1N, 5 credits. The course provides a general understanding of financial relations. The course also deals with methods and techniques for carrying out economic analysis and assessment of different situations in companies. The course is part of the field of Technology, Human and Society (TMS).
- Entrepreneurship and Basic Business Development, G1N, 7.5 credits. The aim of the course is to give the student an understanding of basic concepts and theories of entrepreneurship, as well as apply them in the process from idea development, through business concept and business modeling, to business plan.
- Software Technology - Degree Project (Bachelor of Science in Engineering), G2E, 15 hp.

#### Work Experience

The Department of Computer Science has contacts with a large number of companies in the region. About 200 of these companies are part of the IEC network initiated by Computer Science. The IEC has a large number of activities annually, on which the students of the program are offered to participate. The thesis work is usually done on companies, often on any of the companies affiliated to the IEC.

#### Studies Abroad

In semester 4 or 5, there is possibility to study one semester at a university abroad.

#### Scope of the Programme

The work as an engineer in Software Technology often involves work in an international, multi-faceted environment where cooperation with people of different nationality, gender, religion, etc. is important. Sustainable development means to reduce energy consumption, which can often be done using different IoT solutions. These questions are therefore dealt with in relevant courses, partly in subject courses, but also in the TMS courses, i.e. Technology, Human and Society. There is a stated ambition that the student should be able to attend various international meetings such as foreign guest lecturers and joint courses with exchange students during their program studies.

#### Quality Development

The program is evaluated in periodic written and oral evaluations. Students from all years in the program are invited to annual evaluations, and summary of the evaluations will be available at faculty. Courses are evaluated by written questionnaire at the end of each course. Compilations of course evaluations filed at the faculty are available to students. Each course introduction will include a summary of last course evaluation.

#### Degree Certificate

After completion of studies in accordance with the requirements listed in the Higher Education Ordinance Decree and those of the local examination system at Linnaeus University, students can apply for a degree. Those who have completed the Bachelor of Science Programme in Software Engineering may be awarded the following degree:

##### Bachelor of Science in Engineering

Computer Science with specialization Software Engineering

The diploma certificate is bilingual (Swedish/English). This certificate is also accompanied by a Diploma Supplement (in English).

#### Other Information

The program includes travel in connection with company visits. This could possibly lead to some additional costs for the students.

Some of the courses may be given in English.

Campus studies require personal access to a laptop.