Programme syllabus

Degree Programme in Information and Communication Technology
Civilingenjörsutbildning i informationsteknik
300.0 credits

Valid for students admitted to the education from autumn 19 (HT - Autumn term; VT - Spring term).

This is a translation of the Swedish, legally binding, programme syllabus.

Programme objectives

The students should during the first three years of the education obtain basic understanding and skills in the core areas of information and communication technology: mathematics, electronics, computer engineering, communication and software engineering. During the final two years of the education, knowledge and skills are deepened within an area corresponding to a master's education at KTH or an Erasmus Mundus programme where KTH participates.

In addition to the requirements of the Higher Education Ordinance the following apply:

Knowledge and understanding

To be awarded an engineering degree in information and communication technology, the student should be able to:

- Apply mathematics and basic natural sciences within information and communication technology.
- Analyse technical problems from a systems perspective with an overall view on technical systems and their life cycle from conceptualisation, design, implementation, production, operation, maintenance and decommissioning.
- Follow and benefit from the advancement of knowledge within the area of information and communication technology.

Skills and abilities

To be awarded an engineering degree in information and communication technology, the student should:

- Within the area of information and communication technology, be able to apply creative and critical working methods to formulate and explore problems with modern methods and tools.
- Be able to analyse technical problems from a systems perspective with an overall view on technical systems and their life cycle, including conceptualisation, design, implementation, production, operation, maintenance and decommissioning.
- Be able to work with problem-solving that takes its starting point in demand and functionality, considering the needs of individual's using the product and the technology interplay in the society.
- Have skills of efficient oral and written communication, in Swedish and English, for different target groups, corresponding to what is required for an international career.

Ability to make judgements and adopt a standpoint

To be awarded an engineering degree in information and communication technology, the student should:

- Be able to appreciate that engineering problems are complex, often not well-defined, and sometimes contradictory.
- By practice and reflection have developed the ability to work efficient in groups of different compositions.
Extent and content of the programme

The education comprises five years and 300 credits. The three first years are first-cycle studies and the final two years are second-cycle studies.

KTH's policy is that first-cycle courses are taught in Swedish and that second-cycle studies are conducted in English. The majority of courses for second-cycle studies are consequently in English. Some courses for first-cycle studies can be in English as well, depending on the teachers.

The final two years the student takes a specialisation that corresponds to a master's programme. The available master's programmes can vary over time, as the KTH programmes offered at the master's level may change. Currently, the following master's programmes constitute possible specialisations:

- Computer Science (TCSCM)
- ICT Innovation (TIVNM)
- Information and Network Engineering (TINNM)
- Embedded systems (TEBSM)
- Industrial Management (TINEM)*
- Interactive Media Technology (TIMTM)
- Communication Systems (TCOMM)
- Machine Learning (TMAIM)
- Medical Engineering (TMLEM)
- Software Engineering of Distributed Systems (TSEDM)
- Systems, Control and Robotics (TSCRM)

Erasmus Mundus programmes where KTH participates can, after approval from the programme director also constitute a specialisation. For Erasmus Mundus programmes there are no reserved/guaranteed seats. These programmes must be applied to in competition with other applicants.

Students may be qualified to follow also other master's programme within KTH. If a student wishes to follow a different master's programme than those listed above, consultation shall take place with programme director.

*) Special conditions for TINEM

Students following the master's programme in industrial management (TINEM) should take at least 30 credits of technology courses, primarily from the mandatory courses in one of the following master's programmes:

- Software engineering of distributed systems (TSEDM)
- Communication systems (TCOMM)
- Embedded systems (TEBSM)

Technology courses from other master's programmes can also be selected after consultation with programme director.

The selection of technology courses shall be approved by the programme directors for TINEM and CINTE before starting the courses. This is made by creating an individual study plan.

Eligibility and selection

General admission requirements and the following special admission requirements must be fulfilled in order to be admitted: Mathematics 4, Physics 2 and Chemistry 1 or equivalent. In each of the subjects, applicants must have at least grade E.

The selection process is based on final school grades and test results at the Swedish Scholastic Aptitude Test. Two-thirds of the places are offered based on grade selection and one-third on the Swedish Scholastic Aptitude Test.
Implementation of the education

Structure of the education
Each academic year consists of two semesters which are 20 weeks each, and each semester is further divided into two study periods.

The first two years consists of compulsory and conditionally elective courses. These are scheduled so that primarily two courses are read and completed in each period. Year three has three compulsory courses, conditionally elective courses, and an advanced study project that can also be used as degree project for a Bachelor of Science degree.

The courses in year 1–3 should help the student to acquire a solid foundation of mathematics/natural sciences, basic technological sciences and professional skills. In year three, the choice of specialisation for the second cycle is made. The guiding principle for specialisations is to make use of KTH's master's programmes in the following way:

The courses of the master's programme are read in year 4 and 5. Pre-requisites for respective master's programmes should be met by taking the required courses in year 3. Any requirements on compulsory and elective courses for the master's programme also apply for students on the degree programme in information and communication technology.

Apart from a degree project, at least 60 credits should come from second-cycle courses from the master's programme within the field of information and communication technology. A course in theory of science/research methodology, equivalent to II2202 Research Methodology and Scientific Writing, shall also be included in the degree.

Courses
The programme is course-based. Lists of courses are included in appendix 1. Courses are either compulsory, conditionally elective or elective. For year 1–3 there are two sets of conditionally elective courses labeled “MatNat block” and “IT block”. It is required to complete at least 15 credits of courses from the “MatNat block” and 12 credits of courses from the “IT block”.

It is recommended that the room for elective courses within the programme is used to study pre-requisite courses for the selected master's programme. Pre-requisite courses for the master's programmes are listed at the programme web.

Grading system
Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for courses under certain circumstances.

Grading scale is found in the course syllabus.

Conditions for participation in the programme
Participation requires admission to courses within the programme and course registration.

For further studies, special admission requirements for the course are to be fulfilled. Special admission requirements are listed in the respective course syllabus.

In order to be eligible for second-cycle studies within the integrated Master of Science programmes at KTH, the student are required to complete 150 credits from year one through three. Of these, 110 credits must be from year 1 and 2. In addition to these credits, the bachelor thesis should be completed before Master’s level studies commence.

Degree project
The degree project is the final part of the education. The project work may begin when special admission requirements for the course are fulfilled.

Special conditions for TINEM
For students at the master's programme in industrial management (TINEM) the second-cycle degree project must qualify as a degree project both in industrial management and in information and communication technology. The degree project shall be approved by the programme director for TINEM and for CINTE before starting.

**Degree**

The degree is entitled “Civilingenjörsexamen” - Master of Science in Engineering. The text on the degree certificate states the educational programme, Information and Communication Technology, that has been completed by the student.

Appendix 1 - Course list  
Appendix 2 - Programme syllabus descriptions
Appendix 1: Course list

Degree Programme in Information and Communication Technology (CINTE), Programme syllabus for studies starting in autumn 2019

**General courses**

**Year 1**

**Mandatory courses (60.0 credits)**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID1018</td>
<td>Programming I</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IE1204</td>
<td>Digital Design</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IE1206</td>
<td>Embedded Electronics</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>II1306</td>
<td>Introduction to IT</td>
<td>1.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IS1200</td>
<td>Computer Hardware Engineering</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1610</td>
<td>Discrete Mathematics</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1624</td>
<td>Algebra and Geometry</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1625</td>
<td>Calculus in One Variable</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1689</td>
<td>Basic Course in Mathematics</td>
<td>6.0</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

**Year 2**

**Mandatory courses (22.5 credits)**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID1020</td>
<td>Algorithms and Data Structures</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>II1305</td>
<td>Project in Information and Communication Technology</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IK1203</td>
<td>Networks and Communication</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
</tbody>
</table>
Optional courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>II1307</td>
<td>Active Career</td>
<td>1.5</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

Conditionally elective courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD1351</td>
<td>Logic for Computer Scientists</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>ID1019</td>
<td>Programming II</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IV1303</td>
<td>Modern Software Development</td>
<td>6.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>ME1003</td>
<td>Industrial Management, Basic Course</td>
<td>6.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1626</td>
<td>Calculus in Several Variable</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SK1118</td>
<td>Electromagnetism and Waves</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

Supplementary information

For year 1-3 there are two sets of conditionally elective courses: “MatNat block” and “IT block”. For a degree it is required that at least 15 credits of courses from the “MatNat block” and 12 credits of courses from the “IT block” has been completed.

“MatNat block” (22.5 credits whereof at least 15 credits is required for a degree)

- SF1626 Calculus in Several Variable 7.5 credits
- SK1118 Electromagnetism and Waves 7.5 credits
- DD1351 Logic for Computer Scientists 7.5 credits

Students that are targeting a more hardware/physics oriented master programme it is recommended to take SF1626 Calculus in Several Variable. Students targeting a more software oriented master programme can instead select DD1351 Logic for Computer Science.

“IT block”. (19.5 credits whereof at least 12 credits is required for a degree)

- ID1019 Programming II 7.5 credits
- ME1003 Industrial Management 6 credits
- IV1303 Modern Software Development 6 credits

Year 3

Mandatory courses (43.5 credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG1815</td>
<td>Sustainable Development, ICT and Innovation</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>ID1206</td>
<td>Operating Systems</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>II143X</td>
<td>Degree Project in Information and Communication Technology, First</td>
<td>15.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>Course code</td>
<td>Course name</td>
<td>Credits</td>
<td>Edu. level</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------</td>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>IV1013</td>
<td>Introduction to Computer Security</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1912</td>
<td>Probability Theory and Statistics</td>
<td>6.0</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

**Optional courses**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD2350</td>
<td>Algorithms, Data Structures and Complexity</td>
<td>9.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DD2352</td>
<td>Algorithms and Complexity</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DD2372</td>
<td>Automata and Languages</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DD2401</td>
<td>Neuroscience</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EL1000</td>
<td>Automatic Control, General Course</td>
<td>6.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>EQ1110</td>
<td>Continuous Time Signals and Systems</td>
<td>6.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>EQ1120</td>
<td>Discrete Time Signals and Systems</td>
<td>6.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>IC1007</td>
<td>Human-computer Interaction: Principles and Design</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>ID1212</td>
<td>Network Programming</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>ID1214</td>
<td>Artificial Intelligence and Applied Methods</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>ID1217</td>
<td>Concurrent Programming</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>ID1354</td>
<td>Internet Applications</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>ID2201</td>
<td>Distributed Systems, Basic Course</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ID2202</td>
<td>Compilers and Execution Environments</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ID2213</td>
<td>Logic Programming</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ID2216</td>
<td>Developing Mobile Applications</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>IE1202</td>
<td>Analog Electronics</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IH1611</td>
<td>Semiconductor Devices</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>III307</td>
<td>Active Career</td>
<td>1.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IK1552</td>
<td>Internetworking</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IK2206</td>
<td>Internet Security and Privacy</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>IS2202</td>
<td>Computer Systems Architecture</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>IV1350</td>
<td>Object Oriented Design</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IV1351</td>
<td>Data Storage Paradigms</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>ME2015</td>
<td>Project Management: Leadership and Control</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ME2063</td>
<td>Team Leadership and Human Resource Management</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>
### Course code | Course name | Credits | Edu. level
--- | --- | --- | ---
SF1545 | Numerical Methods, Basic Course | 6.0 | First cycle
SF1546 | Numerical Methods, Basic Course | 6.0 | First cycle
SF1547 | Numerical Methods, Basic Course | 6.0 | First cycle
SG1102 | Mechanics, Smaller Course | 6.0 | First cycle
SH1011 | Modern Physics | 7.5 | First cycle

### Conditionally elective courses

| Course code | Course name | Credits | Edu. level
--- | --- | --- | ---
DD1351 | Logic for Computer Scientists | 7.5 | First cycle

### Supplementary information

For year 1-3 there are two sets of conditionally elective courses: “MatNat block” and “IT block”. For a degree it is required that at least 15 credits of courses from the “MatNat block” and 12 credits of courses from the “IT block” has been completed.

**“MatNat block” (22.5 credits whereof at least 15 credits is required for a degree)**

- SF1626 Calculus in Several Variable 7.5 credits
- SK1118 Electromagnetism and Waves 7.5 credits
- DD1351 Logic for Computer Scientists 7.5 credits

Students that are targeting a more hardware/physics oriented master programme it is recommended to take SF1626 Calculus in Several Variable. Students targeting a more software oriented master programme can instead select DD1351 Logic for Computer Science.

**“IT block”. ” (19.5 credits whereof at least 12 credits is required for a degree)**

- ID1019 Programming II 7.5 credits
- ME1003 Industrial Management 6 credits
- IV1303 Modern Software Development 6 credits

### Elective courses

The listed courses are recommended elective courses.

### Year 4

**Mandatory courses (7.5 credits)**

| Course code | Course name | Credits | Edu. level
--- | --- | --- | ---
II2202 | Research Methodology and Scientific Writing | 7.5 | Second cycle

Or equivalent
Supplementary information

Year 4-5 are studied at a Master's Programme and the programme syllabus for the programme in question applies.

Currently, the following Master's programmes are offered as specialisations:

- Computer Science (TCSCM)
- ICT Innovation (TIVNM)
- Information and Network Engineering (TINNM)
- Embedded systems (TEBSM)
- Industrial Management (TINEM)*
- Interactive Media Technology (TIMTM)
- Communication Systems (TCOMM)
- Machine Learning (TMAIM)
- Medical Engineering (TMLEM)
- Software Engineering of Distributed Systems (TSEDM)
- Systems, Control and Robotics (TSCRM)

Year 5

Mandatory courses (7.5 credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>II2202</td>
<td>Research Methodology and Scientific Writing</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

Or equivalent.

Supplementary information

Year 4-5 are studied at a Master's Programme and the programme syllabus for the programme in question applies.

Currently, the following Master’s programmes are offered as specialisations:

- Computer Science (TCSCM)
- ICT Innovation (TIVNM)
- Information and Network Engineering (TINNM)
- Embedded systems (TEBSM)
- Industrial Management (TINEM)*
- Interactive Media Technology (TIMTM)
- Communication Systems (TCOMM)
- Machine Learning (TMAIM)
- Medical Engineering (TMLEM)
- Software Engineering of Distributed Systems (TSEDM)
- Systems, Control and Robotics (TSCRM)
Appendix 2: Specialisations

Degree Programme in Information and Communication Technology (CINTE),
Programme syllabus for studies starting in autumn 2019

This programme has no specialisations.