Programme syllabus

Master's Programme, Network Services and Systems, 120 credits
Masterprogram, nätverkstjänster och system
120.0 credits

Valid for students admitted to the education from autumn 11 (HT - Autumn term; VT - Spring term).

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

Programme objectives

The field of communication has radically changed our lives and societies. We now take communication services that only have become widely available during the last ten years for granted: for instance, the Web and its search engines; Internet and mobile telephony or peer-to-peer file sharing and social networks. Such services affect our daily lives, they free us in the choice of how and where we work, relax play and socialize. The design of communication networks and services is therefore central for future developments of our societies. The Network Services and Systems master program provides the competence needed to work in this dynamic, challenging and highly interesting field of engineering. The program gives a deep knowledge of network systems and the services they provide, and it prepares the student to work at the forefront of research and development in these areas. The program addresses the vital areas of management and security of networked systems and services, data and multimedia communication in wired and wireless networks, including sensor networks, and industrial information systems. The skill-set includes analytic and simulation tools for evaluating the performance of the systems, as well as a sharpened proficiency in programming.

Knowledge and understanding

For the Master’s Degree, the student should be able to know and understand:

- The scientific fundamentals and practical applications of computer communication for both wired and wireless networks
- Protocol models and their realization, primarily the Internet protocols
- Queuing theory, simulation methodology and systems experimentation for functional and performance evaluation
- Scientific methodology and its application on the field of the program.

Skills and abilities

For the Master’s Degree, the student should be able to:

- mathematically analyze network functions and protocols,
- specify, design and construct parts of communication systems and to implement them in software
- present technical systems and results from studies both orally and in writing, as well as to hold demonstrations of systems
- work independently and in group, to plan and lead work, critically evaluate the quality of one’s work and to be able to continuously improve it
- read and understand research results within the field and to apply the results.

Ability to make judgements and adopt a standpoint

For the Master’s Degree, the student should be able to:
• apply a scientific approach to his or her own technical work
• be conscious of the possibilities and limitations of technology, its role in society and how it is being used nationally and internationally
• be aware of ethical issues concerning research and development. Reference to the local degree policy of the Royal Institute of Technology: The KTH-Handbook 2, section 19.1.

Extent and content of the programme

The program is at the second level and comprises two years of full time study, 120 higher education credits, corresponding to 120 ECTS credits. The program includes compulsory courses in the area of network systems and services, and three tracks, Design, Technology and Enterprise, preparing for research, development or entrepreneurship in the area. The language of instruction throughout the program is English.

Eligibility and selection

Basic admission requirements Basic eligibility to be accepted to the master’s program requires a completed Bachelor's degree, corresponding to a Swedish Bachelor's degree (180 higher education credits), or equivalent academic qualifications from an internationally recognised university. Students should have in addition, good knowledge in English, both in oral and in written forms. Applicants must provide proof of their proficiency in English. For all programs at KTH where English is the language of instruction, the specific eligibility requirement is English B or equivalent.

Specific admission requirements Specific eligibility to the programme requires:

The previous Degree should include:

• at least 60 higher education credits of course work in electrical engineering, computer engineering or computer science
• at least 30 higher education credits course work in mathematics, including calculus, linear algebra and mathematical statistics
• courses passed with distinction, in programming in C or Java, operating systems and signals and systems.

It is recommended that applicants have experience in solving problems using computational software, particularly MATLAB.

The specific eligibility requirements can be assessed as not-fulfilled if:

1. the average grade is less than 75% of the highest grade
2. the degree awarding institution is not considered to meet acceptable quality standards by the authorities of the country in which the institution is located
3. the degree does not qualify for admission to equivalent Master level in the country where the degree is awarded. Reference to the local admission policy of the Royal Institute of Technology: the KTH-Handbook 2, section 11.0-11.9.

The number of places within the study programme is limited. Places in the programme are filled by a selection according to the merit worth which is based on knowledge, work experience and other education-related experiences. Places in the programme are also made available to students with consideration to the bilateral exchange agreements signed by the School of Electrical Engineering for the programme. In order to assess the merit worth, an assessment of the applicant’s knowledge (the applicant’s previous education, from which university the degree was received, subjects), work experience, and other education-related experiences (motivation to study, references) is carried out. The applicant’s academic results are given higher weight than the other parameters.
Implementation of the education

Structure of the education

The program extends over two academic years. Each academic year spans 40 weeks and it is divided into four seven-weeks long study periods. Each study period is concluded by an examination period of between two and five days. There are three extra examination periods for make-up exams following Christmas, following the ordinary examinations in May and immediately before the start of the study period of the academic year.

The education in the program consists of a course block and a master’s thesis project. The courses are studied during the first six study periods and include 30 ECTS credits of obligatory courses, 30 ECTS credits of conditionally obligatory courses, depending on the chosen track. Finally, courses for 30 credits can be freely selected from all KTH courses. The program is concluded by the thesis project that comprises 30 ECTS credits, a full semester of work.

Courses

The programme is course-based. Lists of courses are included in appendix 1.

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.

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Conditions for participation in the programme

Conditions for being promoted to the next academic year is the successful completion of minimally 45 higher education credits; to commence the thesis work, a minimum of 75 higher education credits must be successfully completed.

Recognition of previous academic studies

For a description of the conditions of receiving credit for previous studies according to the policy of KTH, we refer to the KTH policy in the KTH-Handbook 2, section 13.3. The Director of Education at the KTH School of Electrical Engineering makes the decisions about recognition of complete courses.

Degree project

The thesis project comprises 30 higher education credits of work and a major part of the course work, a minimum of 75 higher education credits, must have been completed before the project may commence. The project may be conducted individually or in collaboration with one other student and the topic of the project must provide an in-depth study within the field of the program. The thesis is graded on a scale from A to F. A-E are passing grades, A is the highest grade. The evaluation criteria, which are common to all of KTH, are the technical and scientific contents, the work process and the presentation of the project at the conclusion. Reference: the KTH-Handbook 2, section 15.1-15.6.

Degree

Students who have successfully completed a two-year Master’s programme (120 ECTS) will be awarded a “Teknologimasterexamen”, translated into English as "Degree of Master of Science (two years)". For the degree, the following is required:

- At least 90 higher education credits from the course list
- Pass Degree Project 30 higher education credits Reference to the local degree policy: the KTH-Handbook 2, section 19.1.

Appendix 1 - Course list
Appendix 2 - Programme syllabus descriptions
### General courses

#### Year 1

#### Mandatory courses (30.0 credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK2036</td>
<td>Theory and Methodology of Science with Applications (Natural and Technological Science)</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2120</td>
<td>Internetworking</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2200</td>
<td>Queuing Theory and Teletraffic Systems</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2950</td>
<td>Wireless Networks</td>
<td>7.5</td>
<td>Second 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>
</table>
| DD2352      | Algorithms and Complexity
Track - Design, conditionally elective                                        | 7.5     | Second cycle       |
| DD2385      | Software Engineering
Track - Enterprise, conditionally elective                                       | 6.0     | Second cycle       |
| EH2020      | Industrial Control and Information Systems
Track - Enterprise, conditionally elective                                        | 7.5     | Second cycle       |
| EP2500      | Networked Systems Security
Track - Design and Technology, conditionally elective                              | 7.5     | Second cycle       |
| EP2980      | Wireless Sensor Networks
Track - Technology, conditionally elective                                          | 7.5     | Second cycle       |
| EQ2310      | Digital Communications
Track - Technology, conditionally elective                                         | 9.0     | Second cycle       |
| IK2213      | Network Services and Internet-based Applications
Track - Technology and Enterprise, conditionally elective                           | 7.5     | Second cycle       |
| IK2555      | Wireless and Mobile Network Architectures
Track - Technology and Enterprise, conditionally elective                            | 7.5     | Second cycle       |
### Recommended courses

<table>
<thead>
<tr>
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<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD2448</td>
<td>Foundations of Cryptography</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EL2450</td>
<td>Hybrid and Embedded Control Systems</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EN2401</td>
<td>Image and Video Processing</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EN2500</td>
<td>Information Theory and Source Coding</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2410</td>
<td>Advanced Digital Communications</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ID2203</td>
<td>Distributed Systems, Advanced Course</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

### Supplementary information

Requirements for the two year program:

Select one track and at least 4 conditionally elective course within the track for the two year program (30 hp)

All conditionally elective courses are also recommended electives

### Year 2

#### Mandatory courses (30.0 credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP240X</td>
<td>Degree Project in Communication Networks, Second Cycle</td>
<td>30.0</td>
<td>Second 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>EH2780</td>
<td>IT Management with Enterprise Architecture II, Case Studies</td>
<td>12.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td>Track - Enterprise, conditionally elective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EL1820</td>
<td>Modelling of Dynamical Systems</td>
<td>6.0</td>
<td>First cycle</td>
</tr>
<tr>
<td></td>
<td>Track - Design, conditionally elective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP2210</td>
<td>Performance Analysis of Communication Networks</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td>Track - Design, conditionally elective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP2300</td>
<td>Management of Networks and Networked Systems</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td>Track - Technology, conditionally elective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP2400</td>
<td>Network Algorithms</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td>Track - Design, conditionally elective</td>
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<td></td>
</tr>
<tr>
<td>SF2812</td>
<td>Applied Linear Optimization</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td>Track - Design, conditionally elective</td>
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</thead>
<tbody>
<tr>
<td>EP2510</td>
<td>Advanced Networked Systems Security</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2520</td>
<td>Building Networked Systems Security</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
</tbody>
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Appendix 2: Specialisations

Master's Programme, Network Services and Systems, 120 credits (TNSSM), Programme syllabus for studies starting in autumn 2011

This programme has no specialisations.