Programme syllabus

Master's Programme, Wireless Systems, 120 credits
Masterprogram, trädlösa system
120.0 credits

Valid for students admitted to the education from autumn 13 (HT - Autumn term; VT - Spring term).

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

Programme objectives

This course based master program is focused on enabling technologies for wireless systems. It provides a broad curriculum composed of courses on communication theory, radio communication, signal processing, multimedia processing and communication networks.

Knowledge and understanding

For the master’s degree, the student should:

- show knowledge and understanding about key technologies for wireless systems, including an overview of the area as well as a deeper knowledge within communications theory, signal processing, radio communication and communication networks and insight in the ongoing research and development work
- Show deepened knowledge about methods within the area.

Skills and abilities

For the master’s degree, the student should:

- show the ability to integrate knowledge and analyse, judge and handle complex phenomena, inquiries and situations, even with limited information
- show the ability to independently identify and formulate inquiries and to plan, and with adequate methods, carry out qualified analysis and design of communication systems, within given time constraints
- show the ability to orally, and in writing, clearly present and discuss one’s own conclusions and the knowledge and arguments which are the foundation for them in a dialogue with different groups
- show such a skill which is demanded in order to participate in research and development work within the area

Ability to make judgements and adopt a standpoint

For the master’s degree, the student should:

- show the ability to, within the technical area, make judgments with regards to relevant scientific, social, and ethical aspects and show awareness about ethical aspects in research and development work
- show insight about technology’s possibilities and limitations, its role in society and humans’ responsibility for how it is used
- Show the ability to identify his/her need for further knowledge and take responsibility for developing his/her knowledge.
Extent and content of the programme

The programme is on the second level and comprises 120 higher education credits (equivalent to 120 ECTS). The following specialisations are offered:

- Information Transmission and Processing
- Wireless Networks.
- Multimedia Signal Processing

The language of instruction throughout the programme is English.

Eligibility and selection

Basic eligibility

Basic eligibility to be accepted to the master’s programme requires that the applicant has a degree on the first level consisting of at least 180 higher education credits or a corresponding foreign degree. In addition, good knowledge in English, oral and written, is required.

Specific eligibility

- Previous education must include at least 6 months of studies (corresponding 30 higher education credits) within electrical engineering, electronics, or computer science. Previous education must also have included basic mathematics courses within linear algebra, Fourier methods and probability theory.
- The student must have taken (with passing grades) a course about signals and systems, including material about time-continuous and time-discrete systems, sampling, linear filters and systems, and Fourier methods.
- A good knowledge of English, equivalent to Eng B.

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

1. the average grade is less than 75% of the highest average 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.

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 Wireless Systems 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.

In the case that the merit worth is the same, a lottery will be done to choose which applicant is accepted.

Implementation of the education

Structure of the education

The study year for KTH’s undergraduate programme is divided into four periods. The study periods correspond to about seven weeks of studies with at least 33 study days. Every study period is followed by an exam period consisting of two dispensable days and at least five exam days.

The programme comprises 1.5 years of full-time studies (90 higher education credits), and a half-year degree project (30 higher education credits). The programme includes 42-45 higher education credits of obligatory courses and, furthermore, 12-15 higher education credits of conditionally obligatory courses, depending on the chosen profile. Other courses are chosen from the course list. The degree project can be done whenever during the second study year.
Courses
The programme is course-based. Lists of courses are included in appendix 1.

Beyond the course list, the student can, after assessment, be granted to study other courses which are offered within the Master of Science in Electrical Engineering programme.

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.

Conditions for participation in the programme
For promotion to study year two, the student must have received at least 45 higher education credits from the first year. In order to receive the degree, the student must fulfil the criteria for at least one of the profiles.

Recognition of previous academic studies
Under certain circumstances, and in agreement with the programme director, credits for previous studies can be received according to the local policy of KTH, see http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/prestationer/policy-for-tillgodoraknande-av-hogskoleutbildning-inklusive-bedomning-av-reell-kompetens-1.27200?l=en_UK

Studies abroad
Exchange studies are available through a number of double-degree agreements between KTH and other European universities. The Degree project (Master’s Thesis project) can be performed abroad providing the student has an advisor at KTH and one at the receiving institution and that the work follows the KTH regulations for a Thesis project.

Degree project
The degree project comprises 30 higher education credits and is carried out individually and must be within an area corresponding to the courses which the student has taken. In order to start the degree project, the student must have passed at least 60 higher education credits.

The degree project is graded, according to the A-F scale, based on three KTH-common assessment principles; engineering-related and scientific content, process and presentation.

Degree
Students who have successfully completed a two-year Master’s programme (120 ECTS) will be awarded a "Teknologie masterexamen", 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
- All obligatory courses and at least two out of the three conditionally elective courses for at least one of the profiles
- Between 6 and 15 higher education credits from the list of non-technical (TMS) courses
- Pass Degree Project 30 higher education credits

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

Master's Programme, Wireless Systems, 120 credits (TTLSM), Programme syllabus for studies starting in autumn 2013

**General courses**

**Year 1**

**Mandatory courses (51.0 credits)**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN2600</td>
<td>Project Course on Multimedia Signal Processing (Only mandatory for track - Wireless Multimedia)</td>
<td>12.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ1220</td>
<td>Signal Theory</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>EQ2220</td>
<td>The Sustainable Wireless Systems Engineer</td>
<td>3.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2310</td>
<td>Digital Communications</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2440</td>
<td>Project in Wireless Communication (Only mandatory for track - Information Processing and Transmission)</td>
<td>12.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>IK2507</td>
<td>Wireless Communication Systems</td>
<td>7.5</td>
<td>Second cycle</td>
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</table>

**Conditionally elective courses**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
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</thead>
<tbody>
<tr>
<td>EN2300</td>
<td>Speech Signal Processing (Only conditionally elective for track - Wireless Multimedia)</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EN2401</td>
<td>Image and Video Processing (Only conditionally elective for track - Wireless Multimedia)</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2200</td>
<td>Queuing Theory and Teletraffic Systems (Only conditionally elective for track - Wireless Communications and Networks)</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2300</td>
<td>Digital Signal Processing (Conditionally elective for track - Information Processing and Transmission, Wireless Communications and Networks, Wireless Multimedia)</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2400</td>
<td>Adaptive Signal Processing (Only conditionally elective for track - Information Processing and Transmission)</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>Course code</td>
<td>Course name</td>
<td>Credits</td>
<td>Edu. level</td>
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</tr>
<tr>
<td>EQ2410</td>
<td>Advanced Digital Communications</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Only conditionally elective for track - Information Processing and Transmission, Wireless Communications and Networks</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Recommended courses**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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<tbody>
<tr>
<td>AK1213</td>
<td>Swedish Society, Culture and Industry in Historical Perspective</td>
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<td>First cycle</td>
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<td>DD2448</td>
<td>Foundations of Cryptography</td>
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<td>Second cycle</td>
</tr>
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<td>EH2030</td>
<td>Business Development and Quality Management</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EH2720</td>
<td>Management of Projects</td>
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<td>Second cycle</td>
</tr>
<tr>
<td>EH2790</td>
<td>Requirements Engineering, Introductory Course</td>
<td>4.5</td>
<td>Second cycle</td>
</tr>
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<td>EI2400</td>
<td>Applied Antenna Theory</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EI2420</td>
<td>Electromagnetic Wave Propagation</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EI2423</td>
<td>Principles of Wireless Propagation Channel Modeling</td>
<td>7.5</td>
<td>Second cycle</td>
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<tr>
<td>EI2745</td>
<td>Principles of Wireless Sensor Networks</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EN2202</td>
<td>Pattern Recognition</td>
<td>7.5</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>EP2120</td>
<td>Internetworking</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2210</td>
<td>Performance Analysis of Communication Networks</td>
<td>7.5</td>
<td>Second cycle</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>EP2500</td>
<td>Networked Systems Security</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2460</td>
<td>Seminars in Wireless Systems</td>
<td>3.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2800</td>
<td>Optimal Filtering</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2810</td>
<td>Estimation Theory, Accelerated Program Course</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2820</td>
<td>Matrix Algebra, Accelerated Program</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2831</td>
<td>Foundations in Digital Communications</td>
<td>7.5</td>
<td>Second cycle</td>
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<tr>
<td>EQ2840</td>
<td>Information Theory and Channel Coding, Accelerated Program</td>
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<td>Second cycle</td>
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<tr>
<td>EQ2850</td>
<td>Coding for Wireless Communications, Accelerated Program</td>
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<tr>
<td>EQ2870</td>
<td>Machine to machine communication</td>
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<td>IK2503</td>
<td>Simulation, Accelerated Study Program</td>
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<tr>
<td>IK2504</td>
<td>Wireless Access Protocols</td>
<td>6.0</td>
<td>Second cycle</td>
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<tr>
<td>IK2555</td>
<td>Wireless and Mobile Network Architectures</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>IL2219</td>
<td>Radio Electronics</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>
Course code | Course name | Credits | Edu. level
---|---|---|---
IT2651 | Microwave Engineering | 7.5 | Second cycle
LS1349 | English B2 | 9.0 | First cycle
LS1500 | Swedish A1 | 7.5 | First cycle
LS150N | Swedish A1 | 7.5 | First cycle
LS2304 | English C1 | 9.0 | Second cycle
ME1003 | Industrial Management, Basic Course | 6.0 | First cycle
ME2043 | Leadership in Cross-Cultural Context | 6.0 | Second cycle
ME2072 | Entrepreneurship for Engineers | 6.0 | Second cycle

Supplementary information

Track - Information Processing and Transmission:
- **Mandatory course** EQ2440 Project in Wireless Communication
- **Conditionally elective courses** Select at least two of the following tree courses: EQ2300 Digital Signal Processing, EQ2400 Adaptive Signal Processing, EQ2410 Advanced Digital Communications

Track - Wireless Communications and Networks:
- **Mandatory courses**: IK2510 Wireless Networks, IK2511 Mobile Network Project
- **Conditionally elective courses**: Select at least two of the following tree courses: EQ2300 Digital Signal Processing, EP2200 Queuing Theory and Teletraffic Systems, EQ2410 Advanced Digital Communications

Track - Wireless Multimedia:
- **Mandatory course**: EN2600 Project Course on Multimedia Signal Processing
- **Conditionally elective courses**: Select at least two of the following tree courses: EQ2300 Digital Signal Processing, EN2300 Speech Signal Processing, EN2401 Image- och Video Processing

Year 2

Mandatory courses (22.5 credits)

<table>
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<td>Theory and Methodology of Science with Applications (Natural and Technological Science)</td>
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<td>IK2510</td>
<td>Wireless Networks</td>
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<td>Second cycle</td>
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| **Only mandatory for track - Wireless Communications and Networks**
| IK2511 | Project in Wireless Networks | 7.5 | Second cycle |
| **Only mandatory for track - Wireless Communications and Networks**
**Recommended courses**

<table>
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<tr>
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<td>Speech Signal Processing</td>
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<td>Image and Video Processing</td>
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<td>Adaptive Signal Processing</td>
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<td>IK2514</td>
<td>Wireless Infrastructure Deployment &amp; Economics</td>
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<td>Second cycle</td>
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<td>IK2555</td>
<td>Wireless and Mobile Network Architectures</td>
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<td>Course code</td>
<td>Course name</td>
<td>Credits</td>
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<td>LS1500</td>
<td>Swedish A1</td>
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<td>English C1</td>
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<td>ME1003</td>
<td>Industrial Management, Basic Course</td>
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<td>First cycle</td>
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<td>ME2043</td>
<td>Leadership in Cross-Cultural Context</td>
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<tr>
<td>ME2072</td>
<td>Entrepreneurship for Engineers</td>
<td>6.0</td>
<td>Second cycle</td>
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</table>

Supplementary information

Track - Information Processing and Transmission:

- **Mandatory course**: EQ2440 Project in Wireless Communication
- **Conditionally elective courses**: Select at least two of the following tree courses: EQ2300 Digital Signal Processing, EQ2400 Adaptive Signal Processing, EQ2410 Advanced Digital Communications

Track - Wireless Communications and Networks:

- **Mandatory courses**: IK2510 Wireless Networks, IK2511 Mobile Network Project
- **Conditionally elective courses**: Select at least two of the following tree courses: EQ2300 Digital Signal Processing, EP2200 Queuing Theory and Teletraffic Systems, EQ2410 Advanced Digital Communications

Track - Wireless Multimedia:

- **Mandatory course**: EN2600 Project Course on Multimedia Signal Processing
- **Conditionally elective courses**: Select at least two of the following tree courses: EQ2300 Digital Signal Processing, EN2300 Speech Signal Processing, EN2401 Image- och Video Processing
Appendix 2: Specialisations

Master's Programme, Wireless Systems, 120 credits (TTLSM), Programme syllabus for studies starting in autumn 2013

This programme has no specialisations.