Programme syllabus

Master's Programme, Railway Engineering, 120 credits
Masterprogram, järnvägsteknik
120.0 credits

Valid for students admitted to the education from autumn 17 (HT - Autumn term; VT - Spring term).

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

Programme objectives

Railway transport is experiencing a worldwide renaissance. The technical challenges associated with meeting the growing demand for railway transportation in an efficient and sustainable manner require a considerable number of engineers with education in the field of railways. A large percentage of railway industry engineering staff are nearing retirement, consequently, there is strong and growing demand for graduates with education in railway engineering.

The objective of this programme is to educate engineers for a global industry, administrations and research institutions active in this area. The programme is offered by the Royal Institute of Technology (KTH), in a cooperation with the University of Illinois at Urbana Champaign (UIUC). Together the two universities provides leading expertise in their respective areas of research. The school of Engineering Sciences coordinates the programme at KTH.

Knowledge and understanding

A Master of Science in Railway Engineering shall be competitive on an international market and will have:

- deep knowledge and understanding in the chosen field of technology and proven experience.
- deeper methodological knowledge, including the ability to apply theoretical knowledge on engineering problems.
- as well as deeper insight into current research and development.

Skills and abilities

A Master of Science in Railway Engineering will have:

- ability to with a holistic view critically, independently and creatively identify, formulate and manage complex problems.
- an ability to create, analyze and critically evaluate different technical solutions.
- an ability to plan and use appropriate methods, carry out advanced tasks within a given framework and evaluate this work.
- the skill required to participate in research and development work or to work independently in other qualified areas and thereby contribute to knowledge development.
- the capacity for teamwork and collaboration in groups with different composition.
- an ability to both in national and international groups, orally and in writing clearly explain and discuss their conclusions and the knowledge and the arguments underlying these.

Ability to make judgements and adopt a standpoint

A Master of Science in Railway Engineering will:
• have an ability to make judgments with regard to relevant scientific, social and ethical aspects, and demonstrate awareness of ethical aspects of research and development.
• show insight regarding the possibilities and limitations of engineering science and its role in the society.
• be able to identify the need for further knowledge and take responsibility for keeping personal knowledge up to date.

Complete information on the degree requirements can be found in the local degree policy of KTH, see www.kth.se

**Extent and content of the programme**

Railway Engineering is a two-year (120 university credits) master programme on the advanced level (second cycle). The instruction language is entirely English. About half of the courses are given by UIUC and KTH respectively. The program also includes mobility. At least 15 ECTS credits have to be taken on site at UIUC.

Many courses are taught online by KTH and UIUC specifically for this program. Examination of these courses is not on-line, but at each university.

**Eligibility and selection**

**General eligibility requirements**

A completed Bachelor's degree, corresponding to a Swedish Bachelor's degree (180 ECTS), or equivalent academic qualifications from an internationally recognised university.

English language proficiency equivalent to (the Swedish upper secondary school) English course B/6.

Students in their final year of undergraduate education may also apply to KTH and if qualified, receive a conditional acceptance.

**Specific eligibility requirements**

The applicant must have a basic degree, Bachelor's or similar, from mechanical, civil, vehicle engineering, or a similar programme with sufficient theoretical depth and good academic results. Course work must include linear algebra, differential and integral calculus, differential equations, transforms, rigid body mechanics, solid mechanics.

It is recommended but not required to have some previous knowledge in MATLAB/Simulink or similar software.

**Selection process**

The selection process is based on a total evaluation of the following criteria: University, previous studies (for instance GPA), motivation for the studies (for instance letter of motivation, references). The evaluation scale is 1-75.

The applicant may get a lower evaluation score if a filled-in program-specific summary sheet is missing from the application documents.

**Implementation of the education**

**Structure of the education**

The academic year at UIUC and KTH, starting in end of August / early September and ending in late May/ early June, is divided into two semesters. At KTH each semester is divided into two study periods. Each period lasts approximately seven weeks with at least 33 days of study. Each period is followed by an exam period. In addition to the four regular exam periods, there are four additional re-examination periods: after Christmas, April, after May and immediately proceeding the first study period of the academic year. The academic year has a duration of 40 weeks. Teaching activities may, if necessary, be scheduled outside the academic year.

**Courses**

The programme is course-based. Lists of courses are included in appendix 1.
The programme comprises of about 75 ECTS credits compulsory courses. About half of the compulsory courses are offered by UIUC and KTH respectively. This leaves about 15 credits for optional (elective) courses. The degree project corresponds to 30 ECTS credits.

To create your own profile on the education students must also choose conditionally elective courses the course list in Annex 1, so that the sum, together with the required courses, amounting to at least 75 credits (plus).

Courses from the UIUC will be counted in the Swedish exam.

**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.

The grades pass (P) and fail (F) are used for thesis works.

**Conditions for participation in the programme**

No later than November 15 and May 15 each academic year, respectively, the students are required to make a study registration and course selection for the coming semester. In order for the student to be promoted to the second year of the programme, at least 45 ECTS credits have to be completed during the first academic year (including the re-examination period in August).

**Course application**

As a student at KTH programmes you have to apply for semester courses. The application is done via universityadmission.se and by all programme students.

**Semester registration**

Everyone admitted to an educational programme at KTH must register for the semesters they intend to study. Semester registration is a prerequisite and is required for the registration and reporting of results on courses. You can carry out a web registration at the same time as the semester starts, provided that you have fulfilled requirements for the coming semester.

**Recognition of previous academic studies**

Both classes taught on-site and online courses at UIUC in the context of education, will be transferred to the Swedish exam.

Under certain circumstances, and in agreement with the programme director, credits for previous studies can be received according to the local policy of KTH.

**Degree project**

Students admitted to the programme are required to perform an independent study in the form of a MSc thesis project corresponding to 30 university credits. To begin the degree project, a student must have completed at least 60 university credits of the total course work.

The purpose of the thesis project is that the student should demonstrate the ability to perform independent project work, using and developing the skills obtained from the courses in the programme. The thesis project can either be performed at a university or, more commonly, at a company. The student must actively search for a suitable thesis project in industry; however KTH will provide some assistance with information on suitable points of contact. More information on the KTH policy on the degree project can be found at http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/examensarbete

The degree project is graded with Pass or Fail.
**Degree**

In order to earn Degree of Master of Science in Vehicle Engineering (120 credits), passing grades in all courses, which are included in the student’s study plan are required. The study plan must comprise 120 higher education credits which include a degree project consisting of 30 higher education credits, in the second cycle.

KTH’s local degree ordinance can be found at KTH’s website, www.kth.se.

**Application for degree certificate**

Students shall apply for a degree through the web service by logging into your Personal menu/Applications for degrees at www.kth.se

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

Master's Programme, Railway Engineering, 120 credits (TJVTM), Programme syllabus for studies starting in autumn 2017

General courses

Year 1

Mandatory courses (29.0 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</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td>and Technological Science)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EJ2400</td>
<td>Electric Traction</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2307</td>
<td>Rail Vehicle Technology</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2313</td>
<td>Rail Vehicle Dynamics</td>
<td>8.0</td>
<td>Second 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>AH2029</td>
<td>Railway Signalling System</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>AH2173</td>
<td>Public Transport</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>AH2301</td>
<td>Transport Policy and Evaluation</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2190</td>
<td>Vehicle Acoustics and Vibration</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2229</td>
<td>Vehicle Dynamics Project Course 1</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2230</td>
<td>Vehicle Dynamics Project Course 2</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2231</td>
<td>Applied Vehicle Dynamics Control</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2411</td>
<td>Lightweight Structures and FEM</td>
<td>8.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SG2211</td>
<td>Vehicle Aerodynamics</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

Supplementary information

Compulsory courses studied at UIUC the first year:

CEE408 Railway Transportation Engineering, 7.5 cr
CEE409 Railway Track Engineering, 7.5 cr
CEE598 Advanced Track Engineering, 10 cr
CEE412 High-Speed Rail Engineering, 7.5 cr

**Elective studies which can be studies at UIUC the first or second year:**

CEE410 Railway Signalling and Control
CEE411 Railroad Project Design and Construction
CEE418 Public Transportation
CEE491 Decision and Risk Analysis
CEE498 HSR Construction Management
CEE498 Transportation Safety and Risk
CEE509 Transportation Soils
CEE512 Logistics
CEE598 Railway Terminal Design and Operations

**Year 2**

**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>AH2026</td>
<td>Railway Traffic - Market and Planning, Basic Course</td>
<td>7.5</td>
<td>Second 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>AH2029</td>
<td>Railway Signalling System</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2190</td>
<td>Vehicle Acoustics and Vibration</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2229</td>
<td>Vehicle Dynamics Project Course Part 1</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2230</td>
<td>Vehicle Dynamics Project Course Part 2</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2411</td>
<td>Lightweight Structures and FEM</td>
<td>8.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

**Supplementary information**

Compulsory course studied at UIUC the second year:
CEE498 High-Speed Rail Planning, 7.5 cr

**Elective studies which can be studies at UIUC the first or second year:**
CEE410 Railway Signalling and Control
CEE411 Railroad Project Design and Construction
CEE418 Public Transportation
CEE491 Decision and Risk Analysis
CEE498 HSR Construction Management
CEE498 Transportation Safety and Risk
CEE509 Transportation Soils
CEE512 Logistics
CEE598 Railway Terminal Design and Operations

**Year 3**
Appendix 2: Specialisations

Master's Programme, Railway Engineering, 120 credits (TJVTM), Programme syllabus for studies starting in autumn 2017

This programme has no specialisations.