Programme syllabus

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

Valid for students admitted to the education from autumn 20 (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.

To qualify for the degree of Master of Science in Railway Engineering the student shall be able to:

Knowledge and understanding

- demonstrate broad knowledge and understanding in the scientific field of railway engineering and proven experience, substantial in-depth knowledge in certain parts of the field, and in-depth insight into current research and development work.
- demonstrate in-depth methodological knowledge in parts of the railway engineering field.

Skills and abilities

- demonstrate the ability to, from a holistic perspective, critically, independently and creatively identify, formulate and manage complex issues and situations in railway engineering.
- demonstrate the ability to create, analyse and critically evaluate different technical solutions for rail vehicles and other complex technical systems.
demonstrate the ability to plan and carry out advanced engineering tasks using appropriate methods within a given framework as well as evaluate this work.

demonstrate the skills required to participate in research and development work or to independently work in other advanced contexts so as to contribute to the development of knowledge.

demonstrate the ability to critically and systematically integrate knowledge and analyse, assess and handle complex phenomena, issues and situations even on the basis of limited information.

demonstrate the ability to model, simulate, predict and evaluate the technical characteristics of rail vehicles and other railway engineering systems, even on the basis of limited information.

demonstrate the ability to develop and design rail vehicles and other technical systems and related processes with regard to people’s situations and needs, and the society’s objectives for economic, social and ecological sustainable development.

demonstrate the ability to engage and contribute in teamwork and cooperation in groups of varying composition.

demonstrate ability to clearly present and discuss technical conclusions and the knowledge and arguments behind them in dialogue with different groups, verbally and in writing, in national and international contexts.

Ability to make judgements and adopt a standpoint

- demonstrate the ability to make sound judgements regarding the design and assessment of rail vehicles and other technical systems, taking into account relevant scientific, social, ethical, economic and environmental aspects.

- demonstrate awareness of and insight into possibilities and limitations of technology and science, its role in society and people's responsibility for how it is used, including social and economic aspects, as well as environmental and work environment aspects.

- demonstrate the ability to identify their need of further knowledge and to take responsibility for continuously developing their knowledge and capabilities.

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. Students in their final year of undergraduate education may also apply to KTH and if qualified, receive a conditional acceptance.
• English language proficiency equivalent to (the Swedish upper secondary school) English course B /6. There are different ways to fulfill the English language requirements, see: www.kth.se

Specific eligibility requirements

A Bachelor’s degree, or equivalent, corresponding to 180 ECTS credits, with courses in

Mathematics: must include (i) differential and integral calculus in several variables, (ii) linear algebra, (iii) numerical analysis and (iv) ordinary and partial differential equations and integral transforms equivalent to at least 25 ECTS credits in total.

Applied mechanics: must include rigid body mechanics and solid mechanics equivalent to at least 15 ECTS credits in total.

Selection process

The selection process is based on the following selection criteria: University ranking and study performance from previous University studies. The evaluation scale is 1-75. The applicant will get a lower evaluation score if the mandatory program-specific summary sheet is missing from the application documents, which also applies to Swedish applicants

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.

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

**Conditions for participation in the programme**

For students starting their education from the autumn semester 2018, previous promotion requirements have been replaced with special admission requirements to each course. Admission requirements are specified in the course syllabus.

Vi har inget om hur antagning och registrering går till på UIUC.

**Course application**

As a student at KTH programmes you have to apply for semester courses. The application is done via www.universityadmissions.se

**Course registration**

Students admitted to an educational programme at KTH must register for the courses they intend to study. Course registration is required for the examination and means that the student is active.

**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.

Studies abroad (behålla eller ta bort hela delen?)

Semester three of the programme is spent at University of Illinois at Urbana Champaign (UIUC).

**Studies abroad**

In the third semester of the program is spent at the University of Illinois at Urbana Champaign (UIUC).

**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. The project work may begin when special admission requirements for the course are fulfilled.
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 Railway 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 2020

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</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td>(Natural and Technological Science)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EJ2400</td>
<td>Electric Traction</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2307</td>
<td>Rail Vehicle Technology</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2313</td>
<td>Rail Vehicle Dynamics</td>
<td>8.0 hp</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>AF2201</td>
<td>Bridge Design</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>AH2173</td>
<td>Public Transport</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>AH2301</td>
<td>Transport Policy and Evaluation</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SD2231</td>
<td>Applied Vehicle Dynamics Control</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SG2211</td>
<td>Vehicle Aerodynamics</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

Supplementary information

Compulsory course given att UIUC the first year:
CEE409 Railway Track Engineering, 8 hp, Ges H18

Conditionally Elective courses studied online at UIUC the first year. *Among CEE408 and CEE472 at least one course has to be studied.
*CEE408 Railroad Transportation Engineering, 8 cr given autumn 2019
*CE472 Stuctural Dynamics I, 8 cr, given autumn 2019
CEE410 Railway Signalling and Control, 7.5 hp, given Spring 2020

Mandatory courses + conditionally elective courses = at least 44.5 cr.

Year 2

Supplementary information

Autumn semester year 2 is studied at UIUC (exchange semester).

Compulsory course
CEE412 High-Speed Rail Engineering, 7.5 hp

Conditionally elective courses. At least 22.5 cr has to be studied.
CEE408 Railway Transportation Engineering, 8 cr
CEE498 High-Speed Rail Planning, 7.5 cr
CEE509 Transportation Soils, 8 cr
CEE472 Structural Dynamics I, 7.5 cr
CEE491 Decision and Risk Analysis, 7.5 cr
CEE512 Logistics, 10 cr
CEE598 Railway Terminal Design and Operations, 10 cr
CEE491 Concrete Materials, 10 cr
Appendix 2: Specialisations

Master's Programme, Railway Engineering, 120 credits (TJVTM), Programme syllabus for studies starting in autumn 2020

This programme has no specialisations.