Programme syllabus

Master's Programme, Nuclear Energy Engineering, 120 credits
Masterprogram, kärnenergiteknik

120.0 credits

Valid for students admitted to the education from autumn 18 (HT - Autumn term; VT - Spring term).

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

Programme objectives

The main objective of this programme is to educate skilled engineers for the nuclear industry and the research institutions in Europe and world-wide. The programme is intended for both Swedish students, European students, and students from other parts of the world.

Knowledge and understanding

After graduating from the master programme in Nuclear Energy Engineering, the students will:

- have a good ability to apply mathematics and engineering sciences in the general field of nuclear energy and reactor engineering.
- be able to formulate and approach new problem settings in a scientific manner, by having a creative, critical, and systematic attitude towards engineering practice.

Skills and abilities

After graduating from the master programme in Nuclear Energy Engineering, the students will be able to:

- work out solution strategies to real engineering problems, knowing the capabilities and limitations of different methods and tools.
- explain and simulate the fundamental physical processes taking place in a nuclear reactor
- make design choices ensuring heat removal, controllability and safety of a power reactor
- select materials suitable for economic and safe operation of a commercial reactor
- work efficiently in a teamwork environment, through experience and by being aware of basic group dynamics.
- work efficiently in an international environment, through experience and by being aware of culture differences.
- communicate results and conclusions in a competent and intelligible manner, both orally and in writing.
- follow and participate in research and development in the field of nuclear energy.

Ability to make judgements and adopt a standpoint

After graduating from the master programme in Nuclear Energy Engineering, the students will be able to:

- Critically judge a situation and independently acquire the information and knowledge that is necessary to establish a qualified standpoint.

The local degree policy of KTH can be found at: www.kth.se
Extent and content of the programme

The master programme in Nuclear Energy Engineering at KTH is a two-year (120 university credit) educational programme on the advanced level (second cycle). The instruction language is English. The programme consists of a number of compulsory courses, and a selection of elective courses. The courses are scheduled during the first six periods of the programme, with a mix of compulsory and elective courses in each period. With the foundation of the compulsory courses, and with a suitable selection of elective courses, each student will be able to build his/her specialized expertise in a field of interest. The last two periods in the second year of the programme is dedicated to the degree project.

Eligibility and selection

Basic 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.

Specific eligibility requirements

To be accepted to the master program in Nuclear Energy Engineering, the applicants need to have an academic background in at least one of the following fields; atomic/subatomic physics, mechanical engineering, applied physics, electrical/chemical engineering relevant to power generation/distribution, energy utilisation, material science.

A good knowledge of written and spoken English is also required. Applicants must provide proof of their proficiency in English. For details about the basic requirements, see: http://www.kth.se/studies/programmes/master/admission?l=en_UK

Selection process

The selection process for the master program in Nuclear Energy Engineering is based on a total evaluation of the following selection criteria: university, grade point average (GPA), course work related to the programme, motivation letter, working experiences and 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.

Complete information on the local admission policy can be found at: www.kth.se

Implementation of the education

Structure of the education

The academic year at KTH is divided into four periods. Each period lasts approximately seven weeks, with at least 33 days of study. Each period is followed by an exam period, consisting of two supplementary days and at least five exam days. In addition to the four regular exam periods, there are four additional re-examination periods. The academic year lasts for a duration of 40 weeks. Teaching activities may, if necessary, be scheduled outside of the academic year. The master programme in Nuclear Energy Engineering is built around a selection of compulsory courses scheduled the first six periods of the programme. The compulsory courses are intended to give the students a strong foundation in the various science and engineering fields of nuclear energy. In addition, the students are required to select a number of more specialised courses (from the list in appendix I) of elective courses. The last two periods of the second year are dedicated for the degree project.

Courses

The programme is course-based. Lists of courses are included in appendix 1.
Lists of compulsory courses and elective courses are included in appendix 1. The total number of compulsory courses corresponds to approximately 48 university credits. The degree project corresponds to 30 university credits. The remaining credits (to reach the full 120 credits) should consist of the elective courses, as specified in the list of appendix I. If less than five students register for an elective course, the programme director reserves the right to remove the course from that year's curriculum.

Every student is required to make an individual study plan, in agreement with the programme director of the master programme. The study plan should define which courses are selected from the course list. The study plan should be written at the start of the first period, and should then be updated once per term.

In agreement with the programme director of the master programme, a student may replace one or a few courses in the list of elective courses with other courses from the KTH curriculum, if the external course lies within the general field of the master 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.

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

**Conditions for participation in the programme**

Participation requires admission to courses within the programme and course registration. Course registration is done via the personal menu at www.kth.se

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.

**Course application**

All programme students apply for courses 1-15 November/1-15 May for the next semester. The application is done via universityadmissions.se

**Recognition of previous academic studies**

Under certain circumstances, in accordance to the policy of the Royal Institute of Technology and in agreement with the programme director, credits for previous studies can be received within the frame of the master programme.

**Studies abroad**

After approval by the programme director, part of the studies may be carried out abroad (including the Master’s degree project). The condition is that the parts of the programme carried out abroad should fit in with the educational programme.

**Degree project**

A 30-credit Master’s degree project is carried out at the end of the educational programme (usually the fourth semester). The purpose of the project is to let the student study a problem in more depth than is possible in the courses. The project may be carried out in an academic or industrial environment in Sweden or abroad. The project work may begin when special admission requirements for the course are fulfilled.

The choice of project must be approved by the programme director.

The Degree project is graded with P/F.
Degree

In order to earn a Degree of Master of Science, 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

When the studies at KTH are completed a degree certificate can be applied for.

Application is done by the “personal menu” at www.kth.se

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

Master's Programme, Nuclear Energy Engineering, 120 credits (TNEEM), Programme syllabus for studies starting in autumn 2018

General courses

Year 1

Mandatory courses (38.0 credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH2600</td>
<td>Nuclear Reactor Physics, Major Course</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2603</td>
<td>Radiation, Protection, Dosimetry and Detectors</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2702</td>
<td>Nuclear Reactor Technology</td>
<td>8.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2706</td>
<td>Sustainable Energy Transformation Technologies</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2773</td>
<td>Nuclear Power Safety</td>
<td>6.0</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>MJ2411</td>
<td>Renewable Energy Technology</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2302</td>
<td>Nuclear Physics</td>
<td>8.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2604</td>
<td>Generation IV Reactors</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2605</td>
<td>Radiation Damage in Materials</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2610</td>
<td>Leadership for Safe Nuclear Power Industry</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH262V</td>
<td>Elements of the Back-end of the Nuclear Fuel Cycle: Geological Storage in Precambrian Bedrock</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2701</td>
<td>Thermal-Hydraulics in Nuclear Energy Engineering</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2703</td>
<td>Nuclear Reactor Dynamics and Stability</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2704</td>
<td>Monte Carlo Methods and Simulations in Nuclear Technology</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2705</td>
<td>Compact Reactor Simulator- Exercises in Reactor Kinetics and Dynamics</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2774</td>
<td>Numerical Methods in Nuclear Engineering</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>
### Year 2

#### 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>AK2030</td>
<td>Theory and Methodology of Science (Natural and Technological Science)</td>
<td>4.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2007</td>
<td>Research Methodology in Physics</td>
<td>3.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH204X</td>
<td>Degree Project in Physics, Second Cycle</td>
<td>30.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2614</td>
<td>The Nuclear Fuel Cycle</td>
<td>6.0</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>ED2235</td>
<td>Atomic Physics for Fusion</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EF2200</td>
<td>Plasma Physics</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2605</td>
<td>Radiation Damage in Materials</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2610</td>
<td>Leadership for Safe Nuclear Power Industry</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2615</td>
<td>Neutron Transport Theory</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2772</td>
<td>Chemistry and Physics of Nuclear Fuels</td>
<td>8.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SH2774</td>
<td>Numerical Methods in Nuclear Engineering</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

### Year 3
Appendix 2: Specialisations

Master's Programme, Nuclear Energy Engineering, 120 credits (TNEEM), Programme syllabus for studies starting in autumn 2018

This programme has no specialisations.