Programme syllabus

Master's Programme, Turbomachinery Aeromechanic University Training, 120 credits
Masterprogram, aeroelasticitet i turbomaskiner
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

Beyond the objectives which are specified in the Higher Education Degree Ordinance, there are also specific goals for this programme. After completing the programme, the student will:

Knowledge and understanding

- Have a broad, scientific foundation to be able to work within the turbomachinery aeromechanics area. It should comprise knowledge about turbomachinery steady and unsteady aerodynamics, structural dynamics, vibration phenomena, damping, material aspects as well as vibratory failure mechanisms encountered in turbomachines
- Show broad knowledge within this technical area, including knowledge in mathematics and natural science, and essentially deepened knowledge within certain parts of the area.

Skills and abilities

- Show a good ability to, independently as well as in a group, be able to apply knowledge and abilities in practical activities with regard to relevant scientific professional and social judgement and viewpoints.
- Show good ability to analyze, formulate and manage the technical problems from a system perspective, with a holistic view of their life cycle, from concept / requirements to specification, development, operation and decommissioning, and the ability to set limits, determine the necessary resource usage and manage processes for problem solving / realization
- Possess individual and professional skills like languages, leadership, project management, and communication for work as an engineer in a leadership role or as a leader in a technical intensive company, or in order to be able to continue toward a research career.

Ability to make judgements and adopt a standpoint
• Have very good understanding that engineering-related problems are often complex, can be incompletely defined and sometimes contain conflicting goals and conditions.
• Be aware of the responsibility and the ethical viewpoints which can arise in connection with different technical, organisational, economical, ecological and social activities.

**Extent and content of the programme**

The programme consists of 120 credits which correspond to two years full time studies. The Programme is mainly on the second level.

The Programme is offered within the framework of the Erasmus Mundus master’s programmes.

Partner Universities in the programme Turbomachinery Aeromechanic University Training (THRUST) are:
- KTH – Royal Institute of Technology, Stockholm, Sweden
- DUKE – Duke University, Durham (NC), USA
- ULg – Université de Liège, Liège, Belgium
- AUTH – Aristotle University of Thessaloniki, Thessaloniki, Greece

Possible specialisation areas for the programme:

Specialisations for semester 3:

Unsteady aerodynamics (DUKE)

Structural vibration and fatigue (AUTH)

Aeromechanical & Materials Design (ULg)

The language of instruction for the programme is English.

**Eligibility and selection**

In order to be eligible to the master’s programme, a relevant higher education degree of at least 180 credits, degree of bachelor in science or in engineering, or technical bachelor’s degree with specialization in Mechanical Engineering, Physics, Energy Engineering, Aerospace Engineering or Materials Science /Engineering.

Eligibility may however be assessed as not fulfilled if:

1. The average grade is in the lower third on the grading scale used (above pass level).
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.

Other studies or work experiences are judged on the basis of the actual competences which are referred to.
In addition Graduate Record Exam (GRE) results are required.

A sound and documented knowledge of written and spoken English equivalent of TOEFL score minimum 580/237/92 and the writing section fulfilling the minimum requirement of 22 (iBT) or 4.0 (PBT); or IELTS score minimum 6.5 and the writing section fulfilling the minimum requirement of 5.5; or Cambridge Certificate in Advanced English (CAE) or Cambridge Certificate of Proficiency in English (CPE), minimum grade “C” is required from all applicants.

The selection of students to the programme is performed by the steering committee of the programme, in consultation with the admission offices of all partner universities, and in compliance with the directives given by the European Commission to the Erasmus Mundus programmes.

All applications will be handled by the KTH admission office.

In addition, it is referred to the local admission policy of KTH -- Royal Institute of Technology’s (The KTH Regulations).

**Implementation of the education**

**Structure of the education**

The academic year, semesters (terms) and study periods are described by the KTH regulations ( www.intra.kth.se/regelverk ).

Structure of the programme

The programme extends over four semesters of which the first two are given at KTH. Students following the “unsteady aerodynamics” mobility will spend their second semester at ULg while being enrolled at KTH. During the third semester the students will study at one of the partner universities (DUKE; ULg, AUTH) depending on the specialization chosen. In the fourth (final) semester the students can perform the MSc thesis in an industrial setting in common supervision with researchers from any of the participating universities.

The first two semesters are considered fundamental within the field of turbomachinery in general, aerodynamics and introduction to aeromechanics. In addition courses on the mechanical side (structural dynamics, FEM modelling) are included.

During the first and the second semesters, all students study at KTH. Students following the “unsteady aerodynamics” mobility will spend their second semester at ULg while being enrolled at KTH. Whereas a part of the courses are given as traditional courses at KTH, another part involves lecturing by faculty from the partner universities using web-based distance teaching capabilities. During or close to the Easter break all students will follow a scientific study and seminar session (so-called Easter course) organized by one of the partner universities also involving industry representatives. Between the second and third semesters, a compulsory Summer Internship is to be performed at the involved industry partners where students combine their learning experiences to basic aeromechanical problems in industry. During the third semester the partners other than KTH offer courses within three fields of specialization (see above). Finally, in the fourth semester the students apply their knowledge on a project in industry or at one of the
partner universities to constitute the basis for the master thesis. In the fourth semester, the second compulsory Easter course is given consisting of an advanced discussion on research in the area. Given the geographical spread of students this course will be held as distance course having the students participating remotely. The programme ends with a common, 1 week, wrap-up and degree ceremony (including oral thesis presentation).

The academic year of higher education at KTH consists of 40 weeks divided in 4 periods, each one containing no less than 35 days of tuition followed by one week of examinations.

There are three re-examination periods, in the beginning of January, after the spring semester and before the autumn semester.

For more information about the Academic Year, see http://www.kth.se/student/schema/1.1007?l=en_UK

Courses

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

The programme is in course form. The course structure is outlined in appendix 1, and they will be further described on the programme website www.exploreturbine.eu . The student must register for the individual courses in the way each one of the partner universities decides.

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.

Courses at KTH in first and second level 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.

Since the programme is a result of a cooperation agreement between KTH and four other universities, other types of grading might also be used.

Conditions for participation in the programme

Term enrolment

The students must apply (on a semester basis) for the courses they intend to follow. This application should be sent in not later than Nov 15 and May 15, respectively, during the Semesters 1, 2 and 3 (corresponding to studies during the Semesters 2, 3 and 4, respectively).

In order to be allowed to pass from Semester 1 to Semester 2 the students must have achieved at least 22 credits by the end of the exam period in January and must have attempted to pass all the compulsory assignments (calculations, simulations, laboratory,) present in all courses. At least 80% of these compulsory assignments should have been passed.

To pass from Semester 2 to Semester 3, at least 50 credits should have been achieved by the end of the exam period in August, all compulsory assignments should have been attempted and at least 80% of theses assignments should have been passed.
To pass from Semester 3 to Semester 4, at least 80 credits, should have been achieved by the end of the exam period in January, all compulsory assignments should have been attempted and at least 90% of theses assignments should have been passed.

A student who does not fulfill these requirements must consult the programme director. An individual study plan must be set-up. The main goal with the study plan is that the student should complete remaining courses/course-parts during the next study year. In the study plan, the remaining courses/course-parts and also suitable courses from the next academic year are included. Special regard is taken to the prerequisites of the courses yet to be taken.

Specialisation Selection

The final selection of specialization is carried out during the first term. Limitation to the number of places available at each partner university do apply.

**Recognition of previous academic studies**

Credits from courses taken at another university/higher education institution both in Sweden and abroad, can, under certain circumstances be counted as part of the program. Students wishing recognition of previous academic studies must submit an application to the Programme Steering Committee.

Reference to Policy for recognition of previous academic studies at the Royal Institute of Technology (KTH Regulations).

The application form can be found on the KTH website.

**Degree project**

The degree project corresponds to 30 ECTS.

To start the degree project at least 80 ECTS course credits should have been achieved, all compulsory assignments should have been attempted and at least 90% of theses assignments should have been passed (as described under "Term enrolment" above).

In order to fulfill requirements for obtaining a master degree the project must be part of the required in-depth studies at second level in the main field of study for the programme. The topic of the project must be accepted by the Programme Steering Committee.

The project can be performed either at an industry, community, agency or at one of the partner universities.

The master thesis project will be graded according to the scale A-F as all other courses.

The partner universities might have special requirements for the degree project.

Reference to Rules for the degree project at the Royal Institute of Technology (KTH Regulations).

**Degree**
Masterexamen - Degree of Master (Two Years) - is obtained after completion of the programme. The individual study-plan must be designed so that students, when they graduate, have fulfilled the Swedish national requirements for a degree and have completed courses comprising 120 higher education credits, out of which:

At least 90 credits are at second level, at least 60 credits of which (including a 30-credit master thesis project) consist of in-depth studies in the main field of study.

The name of the degree is “Teknologie masterexamen” - Master of Science (Two Years). The text on the degree certificate states the name of the educational programme completed.

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

Master's Programme, Turbomachinery Aeromechanic University Training, 120 credits (TAETM), Programme syllabus for studies starting in autumn 2013

General courses

Year 1

Mandatory courses (63.0 Credits)

<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>MJ2406</td>
<td>Thermal Power Systems</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2429</td>
<td>Turbomachinery</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2430</td>
<td>Thermal Turbomachinery</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2480</td>
<td>Introductions to Computational Fluid Dynamics and Mathematics</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2481</td>
<td>Aeromechanics Project Course - Part 1</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2482</td>
<td>Measurement Techniques in Aeromechanics</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2483</td>
<td>Advanced Mechanics Vibrations</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2484</td>
<td>Advanced Mechanics and Finite Element Methods</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2485</td>
<td>Introduction to Unsteady aerodynamics</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2486</td>
<td>Aeromechanics Project Course - Part 2</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>
Appendix 2: Specialisations

Master's Programme, Turbomachinery Aeromechanic University Training, 120 credits (TAETM), Programme syllabus for studies starting in autumn 2013

This programme has no specialisations.