



# Programme syllabus

[An accessible version of the syllabus can be found in the Course and programme directory.](#)

## Master's Programme, Medical Engineering 120 credits

Masterprogram, medicinsk teknik

*Valid for students admitted to the education from autumn 12 (HT - Autumn term; VT - Spring term).*

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

### Programme objectives

*Study programme established by committee STH 21010-10-20*

*Valid for students admitted to the education from HT 2011*

The programme corresponds to the two final years of the five year engineering program in Medical engineering at KTH and has as a goal to educate the future engineers for working at the border where technology and medicine meet.

A master from the programme in medical engineering will have the knowledge to within the field of medical engineering both analyze and solve problems as well as thinking in an innovative way.

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 should have:

## Knowledge and understanding

- a deep insight in the field of medical engineering
- a broad knowledge about anatomy, physiology and medical terminology as well as an understanding of the different needs for technical solutions in the healthcare
- knowledge about scientific tools for analyzing, working on and valuing facts as well as understanding how knowledge evolves in natural science, technology and social science

## Skills and abilities

- ability to, both independently and in a group, put knowledge and abilities into practical action, with consideration to relevant scientific, professional and sociological judgments and opinions
- ability to identify, formulate, analyze and solve problems with regards to current circumstances (scientific, engineer-related, and social) based on ethical and professional standpoints
- skills in presentation and communication, especially regarding the healthcare, such that good prerequisites for efficient work are achieved individually as well as in a multinational group

## Ability to make judgements and adopt a standpoint

- a professional and ethical responsibility in scientific, technical, ecological and social activities
- understanding that engineering-related problems, considered from a system perspective are often complex, can be incompletely defined and sometimes contain conflicting conditions
- a will to follow and use the development of knowledge in the field of medical engineering

## Extent and content of the programme

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

All the compulsory courses are on the second level, but some elective courses may be on the first level.

The language of instruction for the programme is mainly English. All compulsory courses are in English, but some elective courses may be given in Swedish. It will however be possible to achieve a full degree using only courses in English.

There are no specializations in the programme, but two different tracks depending on whether the student has a bachelor degree in Medical engineering or not.

# Eligibility and selection

In order to be eligible to apply to the master's programme, a bachelor's degree or corresponding degree in the first level within Engineering Physics, Electrical Engineering, Computer Science, Mathematics or equivalent of at least 180 ECTS, must be completed. The degree must contain courses in Mathematics, Physics, Computing and Electronics equivalent to at least 60 ECTS. The 60 ECTS must contain at least 25 credits in Mathematics, 15 credits in Physics, 10 credits in Computing and 5 credits in Electronics.

Other studies or work experiences are judged on the basis of the actual competencies which are referred to.

The selection to the programme is based on the evaluation of the following criteria: university/higher education institute where the bachelor degree was given, courses relevant to the programme, personal letter with motivation to the choice of programme and a suggestion for the degree project, recommendation letters and references.

In order to be eligible to apply to the master's programme, a bachelor's degree or corresponding degree in the first level within Engineering Physics, Electrical Engineering, Computer Science, Mathematics or equivalent of at least 180 ECTS, must be completed. The degree must contain courses in Mathematics, Physics, Computing and Electronics equivalent to at least 60 ECTS. The 60 ECTS must contain at least 25 credits in Mathematics, 15 credits in Physics, 10 credits in Computing and 5 credits in Electronics.

Other studies or work experiences are judged on the basis of the actual competencies which are referred to.

The selection to the programme is based on the evaluation of the following criteria: university/higher education institute where the bachelor degree was given, courses relevant to the programme, personal letter with motivation to the choice of programme and a suggestion for the degree project, recommendation letters and references.

The reference to KTH's admission policy can be found here [http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/antagning?l=en\\_UK](http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/antagning?l=en_UK)

# Implementation of the education

## Structure of the education

The structure of programme makes it possible for both students who have a bachelor degree in Medical engineering and those with a more general engineering background to study at the programme. In order to guide both these groups through the programme there will be two different tracks.

For the students who have a bachelor degree in medical engineering the structure of the programme will be:

- 30 credits compulsory courses
- 30 credits conditionally elective courses
- 30 credits elective courses
- 30 credits Master thesis

For the students who do not have a bachelor degree in medical engineering the structure of the programme will be:

- 42 credits compulsory courses
- 18 credits conditionally elective courses
- 30 credits elective courses
- 30 credits Master thesis

The students who do not have a bachelor degree in medical engineering will start the first semester with one basic course in medical engineering and one in anatomy and physiology. Besides that the students in both tracks can choose either to start with all the compulsory courses and then the others or to vary between compulsory and elective courses. The compulsory courses will give a broad knowledge about medical engineering and the elective ones give the student a deeper knowledge about some special branches within medical engineering (imaging systems, instrumentation, implants, ...).

In the third semester there is a course in science theory and research methodology to prepare the students for the master's thesis and also for possible future research in the field of medical engineering.

The last term is devoted to a degree project which is carried out in a group of two or individually.

The last term is devoted to a degree project which is carried out in a group of two or individually. Study year, term, and study period descriptions can be found here [http://www.kth.se/student/schema?l=en\\_UK](http://www.kth.se/student/schema?l=en_UK)

## Courses

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

### **Compulsory courses:**

Medical engineering, basic course 6 cr1

Advanced Physiology, smaller course 6 cr1

Ergonomics, Human Factors and Patient Safety 6 cr  
Technology in Surgery, Anesthesia, and Intensive Care 6 cr  
Medical IT 6 cr  
Implants and Biomaterials 6 cr  
Theory and Methodology of Science 6 cr

(1only compulsory for students who do not have a bachelor degree in Medical engineering)

Conditionally elective courses:

Physics of Biomedical Microscopy 7.5 cr

Advanced Physiology, 9 cr

Simulation Methods in Medical Engineering 7.5 cr

IonisingRadiation Imaging 6 cr

Ultrasound 6 cr

Magnetic Resonance Imaging 4.5 cr

Image Analysis and Reconstruction 9 cr

Safe Medical Products 7.5 cr

Radiation Therapy 7.5 cr

Structural Biology and Cell Biology 9 cr

Electro Dynamics and Waves 7,5 cr

Quantum Mechanics of Electron Microscopy 7,5 cr

X-ray Crystallography and X-ray Microscopy 7,5 cr

Electron Microscopy 7,5 cr

Biomechanics and Neuronics 6.0 cr

(some course names and number of credits may be changed).

Besides these courses given by STH there are several other courses in the field of Medical engineering at other schools at KTH.Those courses will also belong to this category

## 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

A condition in order to be able to participate in the studies is that the student must enroll for the next term every spring and fall. This is done via “Mina Sidor” on KTH’s website between November 1st and 15th and between May 1st and 15th.

With the enrolment, the student has submitted their intention of studying and participating in the programme.

Only after that it is possible for the student to:

- register for courses
- register for the term
- get results reported

In order to register for the courses the students must fulfill the specific prerequisites for that course.

Some of the elective courses may have a limitation in the number of participants. In such cases the selection will be based on first the number of credits achieved in the programme and then the grades.

For studies in study year 2 at least 45 higher education credits from study year 1 must be completed by the exam period in August. Students who have not fulfilled this requirement must consult with the study counselor and set up an individual study plan. The main goal with the study plan is that the student should complete the remaining elements during the next study year. In the study plan, the remaining elements and also suitable courses from the next study year are included. Special regard should be taken to the prerequisites of the courses

## Recognition of previous academic studies

The student has the possibility to apply to receive credit from courses taken at another university /higher education institution both in Sweden and from abroad. The application can be found on KTH’s website.

## 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 degree project can be carried out at an industrial company, a hospital or at an academic institution in Sweden or abroad.

More information on KTH policy about Degree project can be found at [http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/examensarbete?l=en\\_UK](http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/examensarbete?l=en_UK)

## Degree

In order to graduate with the Degree of Master of Science (Two Years) within the main area Medical Engineering, a passing grade must be achieved in all courses which are in the student's study plan. The study plan must comprise 120 higher education credits including a degree project consisting of 30 higher education credits.

Students having completed 120 university credits within the framework of the master's programme in Engineering Physics will receive a degree entitled "Master of Science (Two Years)". To receive the MSc degree, students must fill out an application form that is submitted to the programme director and also show proof of their basic degree (bachelor or similar).

KTH's local degree ordinance can be found at [http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/examina?l=en\\_UK](http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/examina?l=en_UK)

Appendix 1 - Course list

Appendix 2 - Programme syllabus descriptions



# Appendix 1: Course list

## Master's Programme, Medical Engineering (TMLEM)

### General courses

Year 1

### Mandatory courses (24.0 Credits)

Code	Name	Credits	Edu. level
<a href="#">HI2010</a>	Medical Information and Communication Systems	6.0 hp	Second cycle
<a href="#">HL2005</a>	Implants and Biomaterials	6.0 hp	Second cycle
<a href="#">HL2016</a>	Technology in Surgery, Anaesthesia, and Intensive Care	6.0 hp	Second cycle
<a href="#">HN2013</a>	Ergonomics, Human Factors and Patient Safety	6.0 hp	Second cycle



## Conditionally elective courses

Code	Name	Credits	Edu. level
<a href="#">DD2400</a>	Cellular and Molecular Biology	15.0 hp	Second cycle
<a href="#">HL1007</a>	Medical Engineering, Basic Course	6.0 hp	First cycle
<a href="#">HL2003</a>	Radiation Physics and Biology	6.0 hp	Second cycle
<a href="#">HL2008</a>	Simulation Methods in Medical Engineering	7.5 hp	Second cycle
<a href="#">HL2013</a>	Radiation Therapy	7.5 hp	Second cycle
<a href="#">HL2014</a>	Safe Medical Devices	7.5 hp	Second cycle
<a href="#">HL2017</a>	Advanced Physiology, Smaller Course	6.0 hp	Second cycle
<a href="#">HL2018</a>	Advanced Physiology	9.0 hp	Second cycle
<a href="#">HL2019</a>	Ionising Radiation Imaging	6.0 hp	Second cycle
<a href="#">HL2025</a>	Structural Biology and Cell Biology	9.0 hp	Second cycle
<a href="#">SD2450</a>	Biomechanics and Neuronics	6.0 hp	Second cycle
<a href="#">SI2700</a>	Protein Physics	7.5 hp	Second cycle
<a href="#">SK2501</a>	Physics of Biomedical Microscopy, Extended Course	7.5 hp	Second cycle
<a href="#">SK2510</a>	Cellular Biophysics I	8.0 hp	Second cycle

## Year 2

### Mandatory courses (30.0 Credits)

Code	Name	Credits	Edu. level
<a href="#">HL202X</a>	Degree Project in Medical Engineering, Second Cycle	30.0 hp	Second cycle

## Conditionally elective courses

Code	Name	Credits	Edu. level
<a href="#">AK2036</a>	Theory and Methodology of Science with Applications (Natural and Technological Science)	7.5 hp	Second cycle
<a href="#">AK2050</a>	Theory and Methodology of Science with Applications (Medical Ethics)	6.0 hp	Second cycle
<a href="#">DD2400</a>	Cellular and Molecular Biology	15.0 hp	Second cycle
<a href="#">EK2350</a>	Microsystem Technology	7.5 hp	Second cycle
<a href="#">HL2008</a>	Simulation Methods in Medical Engineering	7.5 hp	Second cycle
<a href="#">HL2010</a>	Ultrasound	6.0 hp	Second cycle
<a href="#">HL2014</a>	Safe Medical Devices	7.5 hp	Second cycle
<a href="#">HL2019</a>	Ionising Radiation Imaging	6.0 hp	Second cycle
<a href="#">HL2025</a>	Structural Biology and Cell Biology	9.0 hp	Second cycle
<a href="#">HL2027</a>	3D Image Reconstruction and Analysis in Medicine	9.0 hp	Second cycle
<a href="#">HL2028</a>	Biomedical Signal Processing	6.0 hp	Second cycle
<a href="#">HL2029</a>	Medical Engineering, Advanced Course	6.0 hp	Second cycle
<a href="#">HL2032</a>	Medical Engineering, Project Course	9.0 hp	Second cycle
<a href="#">SD2450</a>	Biomechanics and Neuronics	6.0 hp	Second cycle
<a href="#">SE2121</a>	Introduction to Biomechanics	9.0 hp	Second cycle
<a href="#">SG2804</a>	Biomechanics of Human Movement	7.0 hp	Second cycle
<a href="#">SI2700</a>	Protein Physics	7.5 hp	Second cycle
<a href="#">SK2501</a>	Physics of Biomedical Microscopy, Extended Course	7.5 hp	Second cycle
<a href="#">SK2510</a>	Cellular Biophysics I	8.0 hp	Second cycle
<a href="#">SK2511</a>	Cellular Biophysics II	6.0 hp	Second cycle
<a href="#">SK2520</a>	Experimental Methods in Molecular Biophysics	8.0 hp	Second cycle
<a href="#">SK2521</a>	Fluorescence Spectroscopy for Biomolecular Studies	6.0 hp	Second cycle



# Appendix 2: Specialisations

## Master's Programme, Medical Engineering (TMLEM)

This programme has no specialisations.