



Programme syllabus

Master's Programme, Engineering Physics, 120 credits

Masterprogram, teknisk fysik

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 aim of this Master of Science programme is to provide students with mathematics and physics skills suitable for advanced development work in industry, as well as for continued PhD studies. Depending on personal interests, students can choose their tracks within a number of different fields.

Knowledge and understanding

After completing the Master of Science programme in Engineering Physics the student will:

- have a broad knowledge of physics.
- be able to analyse problems and suggest methods for their solution.
- be able to use appropriate approximations to simplify the solution of a problem.
- have a solid basis for continued studies towards a PhD degree in physics or a physics-related subject.

Skills and abilities

After completing the Master of Science programme in Engineering Physics the student will:

- have the ability to apply physics and mathematics methods to solve engineering problems, and to make proper documentation of the results.
- be able to communicate both orally and in writing about technical subjects.
- be experienced in seeking information from various sources.
- be experienced in teamwork and interaction within a group.
- have the ability to make use of new information to develop new skills.

Ability to make judgements and adopt a standpoint

After completing the Master of Science program in Engineering Physics the student will:

- have a responsible attitude towards the use and misuse of science.
- realize the importance of giving due credit to previous contributions and prior knowledge in a research field.
- have an open mind towards accepting good advice and suggestions from different sources.

Extent and content of the programme

The programme, which covers 2 years of studies corresponding to 120 university credits, provides a broad basis in physics for all students. The level of education is second cycle. Students can choose tracks in Biomedical Physics, Nano Physics, Optical Physics, Subatomic & Astrophysics and Theoretical Physics.

The language of instruction is English.

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. A good knowledge of written and spoken English. Applicants must provide proof of their proficiency in English.

Specific eligibility requirements

Students must have a bachelor's degree (or equivalent) in physics or a physics-related subject, with sufficient theoretical depth, and have obtained good academic results. Documented skills are required in mathematics (differential and integral calculus, linear algebra, differential equations & transforms, and statistics) and physics (classical and quantum mechanics, electromagnetism, waves, geometrical optics). Physics courses corresponding to at least 45 ECTS are required.

Selection process

The selection process is based on a total evaluation of the following selection criteria: university, 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.

Students from certain 5-year engineering programs at KTH

For students already admitted to some of the 5-year engineering programmes at KTH, specific rules apply provided that the master programme is a specialisation within their 5-year programme.

Implementation of the education

Structure of the education

The academic year at KTH starts in end of August/beginning of September and ends in end of May /beginning of June. It is divided into four periods, two in the Autumn and two in the Spring. Each period

lasts approximately seven weeks and is followed by an examination period. In addition to the four regular examination periods, there are four additional re-examination periods: before Christmas, in April, immediately after the end of the academic year, and immediately before the start of a new 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 consists of three types of courses: compulsory courses, conditionally elective courses and elective courses. Lists of courses for the different programme tracks are given in appendix 1. The compulsory courses amount to approximately 25 credits for each track, and the conditionally elective courses amount to approximately 70 credits. From the list of conditionally elective courses the students must select courses amounting to at least 25 credits. The elective courses can be chosen from all courses listed for all tracks, or, alternatively, the students may suggest other, non-listed, courses that fit in with the track chosen. The choice of elective courses must be approved by the programme director.

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

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.

Recognition of previous academic studies

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

Parts of the programme and/or the Master's degree project can be carried out abroad in accordance with the KTH policies for exchange studies.

Degree project

The purpose of the degree 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 Master thesis work corresponds to 30 credits on advanced level, or about 20 weeks of full time work. The degree project can either be performed at a university or at a company with suitable infrastructure to provide sufficient supervision and resources for the project (or a combination of those). The degree project should be summarised in a written report and presented orally at a seminar. To begin the degree project

- the student has an agreement with an examiner within a research area belonging to the programme
- has fulfilled the special admission requirements for the course.

The student must actively search for a suitable degree project; however KTH will provide some assistance with information on suitable points of contact. The choice of degree project must be approved by the programme director.

The degree project is graded P/F.

Degree

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, Engineering Physics, 120 credits (TTFYM),
Programme syllabus for studies starting in autumn 2018

General courses

Year 2

Mandatory courses (7.5 Credits)

| Course code | Course name | Credits | Edu. level |
|------------------------|---|---------|--------------|
| AK2030 | Theory and Methodology of Science (Natural and Technological Science) | 4.5 hp | Second cycle |
| SH2007 | Research Methodology in Physics | 3.0 hp | Second cycle |

Supplementary information

After consultation with the programme director, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses.

Track, Theoretical Physics (TFYA)

Year 1

Mandatory courses (15.0 Credits)

| Course code | Course name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| SI2380 | Advanced Quantum Mechanics | 7.5 hp | Second cycle |
| SI2510 | Statistical Mechanics | 7.5 hp | Second cycle |

Optional courses

| Course code | Course name | Credits | Edu. level |
|-------------|-------------|---------|------------|
|-------------|-------------|---------|------------|

[SK2711](#) [Environmental physics](#) 6.0 hp Second cycle

Conditionally elective courses

| Course code | Course name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| SI1142 | Mathematical Methods in Physics, Additional Course | 3.0 hp | First cycle |
| SI1336 | Simulation and Modeling | 6.0 hp | First cycle |
| SI2371 | Special Relativity | 6.0 hp | Second cycle |
| SI2372 | General Relativity | 3.0 hp | Second cycle |
| SI2390 | Relativistic Quantum Physics | 7.5 hp | Second cycle |
| SI2400 | Theoretical Particle Physics | 7.5 hp | Second cycle |
| SI2520 | Nonequilibrium Statistical Mechanics | 7.5 hp | Second cycle |
| SI2530 | Computational Physics | 7.5 hp | Second cycle |
| SI2540 | Complex Systems | 7.5 hp | Second cycle |
| SI2720 | Biophysics | 7.5 hp | Second cycle |

Supplementary information

At least 25 hp of the conditionally elective courses has to be studied. The listing of conditionally elective courses as belonging to year 1 or year 2 is only indicative. Provided that the students fulfil the prerequisites, the courses can be taken during either year.

After consultation with the track guide, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses.

Year 2

Optional courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---------------------------------------|---------|--------------|
| SK2711 | Environmental physics | 6.0 hp | Second cycle |

Conditionally elective courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---|---------|--------------|
| SI2410 | Quantum Field Theory | 7.5 hp | Second cycle |
| SI2600 | Condensed Matter Theory | 7.5 hp | Second cycle |

Supplementary information

After consultation with the track guide, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses

Track, Subatomic and Astrophysics (TFYB)

Year 1

Mandatory courses (15.0 Credits)

| Course code | Course name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| SH2103 | Subatomic Physics | 7.5 hp | Second cycle |
| SI2380 | Advanced Quantum Mechanics | 7.5 hp | Second cycle |

Optional courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---------------------------------------|---------|--------------|
| SK2711 | Environmental physics | 6.0 hp | Second cycle |

Conditionally elective courses

| Course code | Course name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| SH2011 | Theoretical Nuclear Physics | 6.0 hp | Second cycle |
| SH2203 | Experimental Particle Physics | 7.5 hp | Second cycle |
| SH2302 | Nuclear Physics | 8.0 hp | Second cycle |
| SH2306 | Experimental Techniques for Nuclear and Particle Physics | 8.0 hp | Second cycle |
| SH2314 | Medical Imaging, Signals and Systems | 7.5 hp | Second cycle |
| SI2371 | Special Relativity Strongly recommended | 6.0 hp | Second cycle |
| SI2390 | Relativistic Quantum Physics | 7.5 hp | Second cycle |
| SI2400 | Theoretical Particle Physics | 7.5 hp | Second cycle |

Supplementary information

At least 25 hp of the conditionally elective courses the first and second year has to be studied.

After consultation with the track guide, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses.

Year 2

Optional courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---------------------------------------|---------|--------------|
| SK2711 | Environmental physics | 6.0 hp | Second cycle |

Conditionally elective courses

| Course code | Course name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| SH2204 | Astroparticle Physics | 7.5 hp | Second cycle |
| SH2306 | Experimental Techniques for Nuclear and Particle Physics | 8.0 hp | Second cycle |
| SH2403 | Astrophysics, Advanced Course | 6.0 hp | Second cycle |

Supplementary information

At least 25 hp of the conditionally elective courses the first and second year has to be studied.

After consultation with the track guide, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses

Track, Optical Physics (TFYC)

Year 1

Mandatory courses (13.5 Credits)

| Course code | Course name | Credits | Edu. level |
|------------------------|---------------------------------|---------|--------------|
| SK2300 | Optical Physics | 6.0 hp | Second cycle |
| SK2411 | Laser Physics | 7.5 hp | Second cycle |

Optional courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---------------------------------------|---------|--------------|
| SK2711 | Environmental physics | 6.0 hp | Second cycle |

Conditionally elective courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---------------------------------|---------|--------------|
| SK2301 | Optical Physics | 3.0 hp | Second cycle |

| | | | |
|------------------------|---|---------|--------------|
| SK2320 | Problem Solving in Optics | 6.0 hp | Second cycle |
| SK2330 | Optical Systems Design | 6.0 hp | Second cycle |
| SK2340 | Fourier optics | 6.0 hp | Second cycle |
| SK2350 | Optical Measurement Techniques | 6.0 hp | Second cycle |
| SK2400 | Quantum Electronics with Electro Optics | 12.0 hp | Second cycle |
| SK2500 | Physics of Biomedical Microscopy | 6.0 hp | Second cycle |
| SK2550 | X-ray Physics and Applications | 6.0 hp | Second cycle |
| SK2560 | Nanophotonics and Bionanophotonics | 7.5 hp | Second cycle |
| SK2758 | Solid State Physics | 7.5 hp | Second cycle |
| SK2800 | Laser Spectroscopy | 8.0 hp | Second cycle |
| SK2811 | Fiber-optical Communication | 7.5 hp | Second cycle |
| SK2900 | Quantum Photonics | 7.5 hp | Second cycle |

Supplementary information

At least 25 hp of the conditionally elective courses has to be studied. Several courses are listed as conditionally elective for both year 1 and year 2. This means that the students are free to take these courses during either year, as long as the prerequisites are fulfilled (see course descriptions).

Among the conditionally elective courses there is one that can be studied at Stockholm University:

FK7037 Introduction to quantum information and quantum computation.

After consultation with the track guide, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses.

Year 2

Optional courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---------------------------------------|---------|--------------|
| SK2711 | Environmental physics | 6.0 hp | Second cycle |

Conditionally elective courses

| Course code | Course name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| SK2301 | Optical Physics | 3.0 hp | Second cycle |
| SK2320 | Problem Solving in Optics | 6.0 hp | Second cycle |
| SK2500 | Physics of Biomedical Microscopy | 6.0 hp | Second cycle |
| SK2560 | Nanophotonics and Bionanophotonics | 7.5 hp | Second cycle |
| SK2800 | Laser Spectroscopy | 8.0 hp | Second cycle |

| | | | |
|------------------------|---|--------|--------------|
| SK2811 | Fiber-optical Communication | 7.5 hp | Second cycle |
| SK2902 | Light-matter Interaction | 7.5 hp | Second cycle |

Supplementary information

After consultation with the track guide, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses.

Track, Nanophysics (TFYD)

Year 1

Mandatory courses (16.0 Credits)

| Course code | Course name | Credits | Edu. level |
|------------------------|------------------------------------|---------|--------------|
| SK2700 | Mesoscopic Physics | 8.0 hp | Second cycle |
| SK2710 | Spin Electronics | 8.0 hp | Second cycle |

Optional courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---------------------------------------|---------|--------------|
| SK2711 | Environmental physics | 6.0 hp | Second cycle |

Conditionally elective courses

| Course code | Course name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| SI2380 | Advanced Quantum Mechanics Strongly recommended | 7.5 hp | Second cycle |
| SI2510 | Statistical Mechanics | 7.5 hp | Second cycle |
| SI2520 | Nonequilibrium Statistical Mechanics | 7.5 hp | Second cycle |
| SI2530 | Computational Physics | 7.5 hp | Second cycle |
| SK2400 | Quantum Electronics with Electro Optics | 12.0 hp | Second cycle |
| SK2550 | X-ray Physics and Applications | 6.0 hp | Second cycle |
| SK2560 | Nanophotonics and Bionanophotonics | 7.5 hp | Second cycle |
| SK2758 | Solid State Physics | 7.5 hp | Second cycle |
| SK2759 | Superconductivity and Applications | 6.0 hp | Second cycle |
| SK2900 | Quantum Photonics | 7.5 hp | Second cycle |

Supplementary information

At least 25 hp of the conditionally elective courses has to be studied. Several courses are listed as conditionally elective for both year 1 and year 2. This means that the students are free to take these courses during either year, as long as the prerequisites are fulfilled (see course descriptions).

Among the conditionally elective courses there are three that can be studied at Stockholm University: FK7018 Nanotechnology, 7,5 cr, FK7019 Superconductivity, 7,5 cr (as an alt. to SK2758) and FK7037 Introduction to quantum information and quantum computation, 7,5 cr.

After consultation with the track guide, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses.

Year 2

Optional courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---------------------------------------|---------|--------------|
| SK2711 | Environmental physics | 6.0 hp | Second cycle |

Conditionally elective courses

| Course code | Course name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| SI2380 | Advanced Quantum Mechanics | 7.5 hp | Second cycle |
| SI2510 | Statistical Mechanics | 7.5 hp | Second cycle |
| SI2530 | Computational Physics | 7.5 hp | Second cycle |
| SI2600 | Condensed Matter Theory | 7.5 hp | Second cycle |
| SK2560 | Nanophotonics and Bionanophotonics | 7.5 hp | Second cycle |
| SK2759 | Superconductivity and Applications | 6.0 hp | Second cycle |

Supplementary information

After consultation with the track guide, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses

Track, Biomedical Physics (TFYE)

Year 1

Mandatory courses (20.0 Credits)

| Course code | Course name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| SK2520 | Experimental Methods in Molecular Biophysics | 8.0 hp | Second cycle |

[SK2531](#) [Biomedicine for Engineers](#) 12.0 hp Second cycle

Optional courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---------------------------------------|---------|--------------|
| SK2711 | Environmental physics | 6.0 hp | Second cycle |

Conditionally elective courses

| Course code | Course name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| HL1007 | Medical Engineering, Basic Course | 6.0 hp | First cycle |
| HL2010 | Ultrasound | 6.0 hp | Second cycle |
| SH2314 | Medical Imaging, Signals and Systems | 7.5 hp | Second cycle |
| SI2530 | Computational Physics | 7.5 hp | Second cycle |
| SI2720 | Biophysics | 7.5 hp | Second cycle |
| SK2500 | Physics of Biomedical Microscopy | 6.0 hp | Second cycle |
| SK2512 | Cellular Biophysics | 10.0 hp | Second cycle |
| SK2513 | Cell Culture: Theory and Practice | 4.0 hp | Second cycle |
| SK2550 | X-ray Physics and Applications | 6.0 hp | Second cycle |
| SK2560 | Nanophotonics and Bionanophotonics | 7.5 hp | Second cycle |

Supplementary information

At least 25 hp of the conditionally elective courses has to be studied. Several courses are listed as conditionally elective for both year 1 and year 2. This means that the students are free to take these courses during either year, as long as the prerequisites are fulfilled (see course descriptions).

After consultation with the track guide, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses.

Year 2

Optional courses

| Course code | Course name | Credits | Edu. level |
|------------------------|---|---------|--------------|
| HL1007 | Medical Engineering, Basic Course | 6.0 hp | First cycle |
| SK2711 | Environmental physics | 6.0 hp | Second cycle |

Conditionally elective courses

Course

| code | Course name | Credits | Edu. level |
|------------------------|--|----------------|-------------------|
| SI2530 | Computational Physics | 7.5 hp | Second cycle |
| SK2500 | Physics of Biomedical Microscopy | 6.0 hp | Second cycle |
| SK2513 | Cell Culture: Theory and Practice | 4.0 hp | Second cycle |
| SK2521 | Fluorescence Spectroscopy for Biomolecular Studies | 6.0 hp | Second cycle |
| SK2560 | Nanophotonics and Bionanophotonics | 7.5 hp | Second cycle |

Supplementary information

After consultation with the track guide, students may choose appropriate courses from all the course lists of the different tracks. It is also possible, after consultation with the programme director, to choose other, non-listed, courses



Appendix 2: Specialisations

Master's Programme, Engineering Physics, 120 credits (TTFYM),
Programme syllabus for studies starting in autumn 2018

Track, Theoretical Physics (TFYA)

The theoretical physics track provides the students with a broad education in fundamental theoretical physics, preparing them for a future as problem solvers or researchers in industry, or for continued PhD studies. The compulsory courses in quantum mechanics and statistical mechanics provide basic theoretical tools that are needed for the more specialised courses. The conditionally elective courses provide tracks towards particle physics, mathematical physics, condensed matter physics and theoretical biological physics. Suitable elective courses can then provide deeper knowledge concerning theoretical and mathematical physics, or experimental physics.

Track, Subatomic and Astrophysics (TFYB)

The subatomic and astrophysics track covers a selection of basic science topics at the front-line of contemporary physics. Both the experimental and theoretical aspects of atomic, nuclear, and particle physics with applications to astrophysics, are included. The application of basic science to real-life problems is illustrated through medical imaging and treatment techniques. The aim of the track is to prepare students for careers at international research facilities, university-based research groups or high-technology industry. The compulsory courses provide a broad orientation in the concepts of subatomic physics, and an advanced discussion of quantum mechanics. The conditionally elective courses allow students to study several fields in more detail, and explore the resulting synergy which is necessary for a fundamental description of the Universe. The elective courses allow students to further focus their studies on a particular research field, broaden their studies within the track, or further explore applications within basic science, industry and society.

Track, Optical Physics (TFYC)

Optical physics is important in basic and applied research, as well as in industrial applications. Students with a good knowledge in this field are much sought after as PhD students, as well as for positions in industry and consulting. The compulsory courses will provide a good knowledge of optics and laser physics, thereby providing a good foundation for many of the other courses. Many courses provide skills in practical problem solving, which prepares the students for independent research and development work.

Track, Nanophysics (TFYD)

Nano physics is of fundamental importance in a broad spectrum of technological applications. In this track a number of highly interesting current fields are treated, such as nano structures, nano magnetism & spin electronics, superconductivity and other phenomena with very special properties. The students will receive a good basic education suitable for a career in high-technology industry, as well as for continued studies towards a PhD degree.

Track, Biomedical Physics (TFYE)

In this track knowledge and skills in physics are developed towards applications and research in the life sciences, including biology, chemistry and medicine. Interdisciplinary activities have become increasingly important for the development of new medical diagnostic methods and treatments. Biomedical physics is in the centre of these activities. This track aims at developing the ability of the physicists to interact with the life science disciplines and offers suitable combinations of subjects both for a career in industry as well as for continued studies towards a PhD degree. The need for improvements in the medical field is practically infinite. Through the choice of courses the students can focus on experimental as well as theoretical approaches of biomedical physics, used on different spatial scales, from the molecular and cellular level up to the organ(ism) and population level.