Programme syllabus

Master of Science in Engineering and of Education
Civilingenjör och lärare
300.0 credits

Valid for students admitted to the education from autumn 07 (HT - Autumn term; VT - Spring term).

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

Programme objectives

In a time of rapid technological development, there is a large need of engineers with the competence to act as an intermediary for knowledge and to develop knowledge within the industry, administration, and academia. There is also a pronounced need for teachers who can arouse interest in the mathematics, technology, and natural science subjects in students. The combination programme, Master of Science in Engineering and of Education, results in a Master’s degree from The Royal Institute of Technology and a teaching degree from The Stockholm Institute of Education within one of the subject combinations: math/physics, math/computer science or math/chemistry. The programme gives both the competencies to work as a pedagogical engineer and work as a teacher mainly within upper secondary schools and adult education institutions.

In The Higher Education Act (http://www.hsv.se/lagochratt/lagarochregler), the goals for fundamental higher education can be found. In The Higher Education Ordinance, the goals for the Master of Science in Engineering degree and the Master of Science of Education degrees, respectively, can be found. (Appendix 2-3)

For KTH’s Master of Science in Engineering programme, the common goals can be found in the KTH-handbook (http://www.kth.se/info/kth-handboken/II/19/1.html), and for the Master of Science of Education at LHS, there is an interpretation of national and local committee documents (appendix 4).

In addition to that, KTH and LHS have the following common goals for the Master of Science in Engineering and of Education programme:

The newly graduated CL-engineer/teacher should, after a short introduction at the work place, be able to independently carry out relatively qualified tasks within his/her profile area. The CL-engineer/teacher should independently and together with others, be able to plan, execute, evaluate, and develop lectures in the school and in other educational environments, for example, the museum area or business education and participate in the leadership of this. This involves having developed the ability to handle a modified and widened teaching assignment in the foremost high schools. After a few years qualified professional work,
the engineer should be able to independently contribute in the utilization and development of new, internationally competitively-powerful technology while observing humane, ethical, and social factors, and, in addition, be able to make judgements of those long-term consequences for the environment.

In The Higher Education Ordinance, the goals for different degrees are grouped under Knowledge and Understanding, Skills and Abilities, and the Judgment and Approach. KTH and SU have commonly developed the following goals:

**Knowledge and understanding**

After fulfilling the education, a student in the programme, Master of Science in Engineering and of Education, should:

- show a deepened knowledge about central concepts, principles and methods within respective subject combinations.
- show understanding for how technology and natural science as well as pedagogy and subject didactics have a scientific foundation of theory building, empiricism and reliable experience.
- show knowledge about mathematics’ scientific foundation and its logical-deductive structure.
- show knowledge about education, as well as youth- and adult- learning within mathematics and physics/computer science/Chemistry. show extensive knowledge to analyse and assess youths’ and adults’ knowledge development and good knowledge in grading within his/her subject combination.
- show knowledge about group and organisational processes, relations between leaders and groups and about the importance that such processes and relations are characterised by equality, respect and the principle that all people are equal.

**Skills and abilities**

After fulfilling the education, a student in the programme, Master of Science in Engineering and of Education, should:

- show deepened abilities to critically and independently systemise and reflect over both one’s own and others’ experiences and relevant research results in order to, through that, support development of professional work and knowledge development within mathematics and physics, computer science, or chemistry.
- show the ability to independently search, assimilate, and evaluate new knowledge within mathematical, natural-scientific, technical, and educational-scientific areas and identify the need to further develop that knowledge.
- show a good ability to independently analyse technical, natural scientific and mathematical problems and be able to carry out important types of reasoning and calculation in these areas.
- show the ability to independently, and together with others, lead, plan, carry out, evaluate and develop teaching and education within schools, businesses and organisations.
- show the ability to, within one’s own subject area, plan technical and natural-scientific experiments and measurements and evaluate the results.
- show the ability to, with mathematical models, describe technical and natural-scientific courses of events and judge these models’ possibilities and limitations in different situations.
- show the ability to use and reflect upon information and communication technology’s possibilities in problem solutions within one’s own subject area and for pedagogical and communicative usage.
• show a good ability to, within both of the professional areas, communicate knowledge, experiences, and professional judgments, orally, as well as in writing; and, lead and collaborate in professional discussions

**Ability to make judgements and adopt a standpoint**

After fulfilling the education, a student in the programme, Master of Science in Engineering and of Education, should:

• show the ability to evaluate technology’s possibilities and limitations, especially in relation to economically, socially and ecologically sustainable development.
• show instincts in questions which depend on ethnicity, gender, and conditions for sustainable social development
• show the ability to actively participate in democratic consideration and decision processes in a way which exhibits empathy, understanding and respect for individuals and groups with different social, cultural, and religious backgrounds

**Extent and content of the programme**

The program Master of Science in Engineering and of Education (CL) is established at KTH and is given in cooperation with the Stockholm University (Teacher Training). The programme gives the student two degrees on the second level, a Master of Science in Engineering from KTH with one of the subject-combinations mathematics/physics, mathematics/computer science and mathematics/chemistry, and a teaching degree from SU with the corresponding specialisations.

The programme consists of 300 higher education credits and is normally divided into 5 years/10 terms.

The programme has three subject-combinations; mathematics/physics, mathematics/computer science and mathematics/chemistry, where the first year of the programme is common to all combinations. Choice of subject-combination is done at the time of application to the programme.

The programme is given mainly in Swedish, but courses in English can occur during the programme. Usage of English course literature may occur during the entire programme.

The programme combines pedagogy, communication and teaching with the Master of Science in Engineering’s ability to assimilate new knowledge and solve problems. This prepares the student for the work market in school as well as in knowledge companies and industry. The programme gives competencies to work as a teacher, especially within high schools and adult education institutions. Also, the Master of Science in Engineering’s work area and carrier path stands open.

The programme consists of the following parts:

Around 180 higher education credits mathematics and physics, computer science or chemistry including subject didactics corresponding to 30 higher education credits within the respective subject-combination.

45 higher education credits in the general education area (pedagogy, didactics, special-pedagogy, child- and youth-science)
Around 35 higher education credits in interdisciplinary courses in relation to technology, communication and learning.

A smaller allocation of about 10 higher education credits for further subject specialisation or studies within the complementing areas, for example, project management

An interdisciplinary degree project within the area technology and learning, about 30 higher education credits.

**Eligibility and selection**

*Eligibility and selection* For acceptance to the programme Master of Science in Engineering and of Teaching, special eligibility is required. For applicants from the Swedish high school (gymnasium) programme, this means a grade of pass or higher must have been achieved in the following courses:

- Mathematics course D
- Physics course B
- Chemistry course A
- Swedish course B
- English course B
- Social studies course A


**Implementation of the education**

**Structure of the education**

The study year for KTH’s first level programme is divided into four periods. The study periods are equivalent to approx. seven weeks, of which, at least 33 days are study days. Every study period is followed by an exam period consisting of two student-dispensable days and at least five exam days. Beyond the four ordinary exam periods, there are three re-exam periods: after Christmas, after the study year’s last ordinary exam period, and directly before the study year’s first study period.

The study year consists of 40 weeks. With need, tutelage can continue beyond the study year. Study year 1 and 2 in KTH’s Master of Science in Engineering programme is carried out without period division. For the programme Master of Science in Engineering and of Education, parts of study year 3 are taken without period division, since a portion of the courses are taken at the same time with the first year’s courses in other programmes. This means the point in time when a course begins and ends respectively is planned from an overview perspective in the programme. Ordinary exams are taken during the study year at a suitable point in time and must be preceded by one study period of at least four lecture-free days, including Saturday and Sunday. In the CL-programme, alternative examination forms exist, for example, hand-in assignments, group work and presentations, which, as an advantage, are taken in the period-free study years.

During the first year, basic subjects such as mathematics and programming techniques are taken, but also courses which give insight in the coming work profession. Already, in the first term, a course in
engineering science at KTH and a course at SU which gives an introduction to the teacher’s role and the teaching profession are taken. Parallel to the first mathematics course, mathematical didactics is taken and the student is then introduced to the high school where a large portion of the, so called, internship (VFU) will be done.

From the second year and after, other specialisation subjects (physics, computer science or chemistry) are taken. The studies within these courses are mainly taken together with other Master of Science in Engineering programmes.

A carrying idea in the programme is that studies in subject-theory and technology must be weaved in with courses within didactics and educational science and with interdisciplinary courses during the entire programme.

Except for the choice of subject-combination which is done already at the time of application, the choices within the programme are limited.

Courses

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

In the programme, obligatory and conditionally options courses are included. The obligatory courses are defined in the teaching and time plans for every study year and specialisation. The courses’ goals, prerequisites, contents and examination can be found in the course plans.

In the course list, the number of conditionally optional and completely optional courses for the respective subject-combinations is listed. There are also rules for conditionally options courses listed here. In the specialisation for mathematics and computer science, there is also room for completely optional courses, although with the following limitations:

- Optional courses may not be taken in study year 1
- The number of higher education credits which may be chosen per term can be limited.
- Optional courses may not overlap existing programme courses to a meaningful extent
- Higher education preparation courses may not be counted as optional courses
- Courses, within a subject, on a lower level than existing programme courses may not be counted as optional courses

VFU Internship The programme includes 45 higher education credits of internship (VFU). It does not constitute its own course, but is included as portions of certain courses. The general programme area, those didactical courses within respective subject-combinations and degree projects consist of 15 higher education credits VFU.

In the internship portions of the programme, the student must learn about the complex work in schools and other education environments and tie one’s own knowledge development to these, and the questions which they actualise. The content in VFU is decided by the courses it is included in and must be specified in the respective course plans. The majority of the VFU which belongs to the general programme area and the didactics courses is tied to high school (gymnasium), but the programme also gives the possibility of VFU in other pedagogical work areas, for example, museums, Science Centres and educational companies.

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**

**Description of term enrolment**

Before every term, the student must submit an obligatory study enrolment to the study guidance. Without the study enrolment, the term and course registration cannot be done for the term. Term and course registration are required in order for the results to be reported and in order to receive aid from CSN.

The enrolment is done on “Mina Sidor”: www.kth.se/student

The last day for the study enrolment before the next term is normally November 15th and May 15th, respectively.

*Observe that one who has not submitted study enrolment and completed term registration risks losing his/her VFU-place and, with that, possibly the chance to complete courses which consist of internship portions.*

**Temporary Postponement**

Temporary postponement means that the student does not participate in the lecture during at least one study period.

Granted temporary postponement gives the student the right to resume the studies at a given point in time. During the temporary postponement, the student may complement and participate in the course examinations which have not yet been completed.

The application for temporary postponement is submitted to the programme office which approves or denies the application. When the student decides to resume the studies, the student must submit a new study enrolment.

**Course selection**

The student is responsible to apply to the optional or conditionally option courses which he/she wishes to take the following term. The application to these courses must be submitted to the office SCI at the latest:

- May 15th, before the Fall term
- November 15th, before the Spring term

The application is done on a web-form on ”Mina sidor”.

Applications which are submitted after the last application date are considered with respect only to space considerations. Before the selection of language courses, a test for level of competence must be done.

Course enrolment to obligatory courses happens automatically through the office. The student must register him/herself in the course at the first scheduled lecture. Course registration for obligatory courses and
optional courses must be done individually in the respective institution. A student who registers for a course and then decides to discontinue the course must notify the appropriate institution as soon as possible.

**Conditions for promotion to the next year**

The following point limitations apply for advancement to the next study year: For studies in study year 2, at least 45 higher education credits must be completed.

For studies in study year 3, at least 90 higher education credits must be completed.

For studies in study year 4, at least 135 higher education credits must be completed.

In addition, all courses which are prerequisites to courses in the next study year must be completed by August, at the latest. A student which does not fulfil the requirements for advancement to the next study year must contact the study difficult at KTH in order to construct an individual study plan.

**Recognition of previous academic studies**

The right to receive recognition for previous academic studies is an important incentive for the mobility within the country and between countries, for the higher education institution’s internationalisation work and for the principle of life-long learning.

KTH has a generous method for recognition of previous academic studies which can be given even if the exact programme does not exist at KTH or if the course plans don’t completely match those at KTH. The requirements which KTH normally puts on the programme’s level and quality must be taken into consideration at the time of recognition.

Recognition of previous academic studies which is done at another higher education institution in Sweden will normally be accepted by KTH.

Students at KTH have the right to request a trial of recognition of previous academic studies. Even one who is not a student but has academic education and will complete it will mostly likely be able to have the application evaluated and receive a preliminary decision (i.e. advanced notification) about the recognition.

Students at KTH, who study at another university within the boundaries of the exchange programme, have the right to receive advanced notification about recognition of previous academic studies. Such a decision can be given though a, so called, Learning Agreement established and signed by the coordinator at KTH, contact person at university abroad, and by the student. Decisions about recognition of previous academic studies of courses can be appealed at the Board of Appeals for higher education institutions. The appeal must be submitted to KTH at least three weeks from the day the student was notified of the decision.

In order for the request for recognition of previous academic studies to be tested, the applicant must be able to document that he/she has completed the course with at least a passing grade. When a course, which has been graded by another higher education institution, is recognised for credits, no grade is recorded in the degree certificate.

See more http://www.kth.se/info/kth-handboken/II/13/3.html
Studies abroad

Students in the programme Master of Science in Engineering and of Education have the possibility to study at certain foreign higher education institutions during a half study year without the need to pay the course fees which are normally paid by the foreign students. Exchange studies can occur during the third, fourth or fifth study years. It is also possible to do the degree project abroad. For more information, contact the office’s administrator for studies abroad. See also http://www.kth.se/student/utlandsstudier

Degree project

Degree project in technology and learning

Included in the programme is a degree project comprising 30 higher education credits corresponding to about 20 weeks of full-time work. The degree project is normally the concluding course in the programme and must be on the second level. It must show proof of an independent work within technology and learning and include theoretical and/or experimental work with following written report and reporting, including opposition. The degree project must also have a clear connection to the teaching assignment and 15 higher education credits of degree project work are awarded by the internship studies connected to the student’s subject combination. The following are named as examples of suitable degree project areas:

- Development of interactive software for pedagogical use, with testing and evaluation in a school environment
- Development of technical equipment for laboratory goals, with testing and evaluation in a school environment
- An analysis and evaluation of existing pedagogical software or technical equipment in the school environment, with consideration to the interaction between human, technology and pedagogy.
- An analysis of teaching mediums and their usage in schools. How are these teaching mediums related to the scientific tradition within the subject?
- The usage of Science Centres in order to develop high school students’ understanding for technical and natural-scientific phenomena.
- The mathematics for the working engineer. How does mathematics appear in the working environment and how can it affect the engineering programme.
- Study of educational organisations at technology companies, with suggestions of improvements of efficiency of education and competence development.

Admission to the course assumes that the student has attained at least 240 higher education credits and carried out the course, work in the school, 15 higher education credits.

Choice of degree project

The subject for the degree project can be suggested by the student, KTH- or SU- institutions, higher schools, Science Centres, or companies. Since the internship, corresponding to 15 higher education credits, is included in the degree project, the work must be proportionally assigned to high school, junior high, Science Centres and/or companies.

Read more on the student web, for CL: http://www.kth.se/student/examen?programme=clmke.

Grading of the degree project
The degree project is allotted grades according to the scale A-F from the assessment criteria: Process, engineering-related and scientific contents and presentation. In the CL-programme’s degree project, the grading may be based on further criteria.

The grade is determined by the examiner from an overview-assessment standpoint and after the degree project report has been checked for plagiary. In order to pass the degree project, the project must not fail to meet any of the assessment-criteria with a score of fail. Details about grading can be found in the course plan for the degree project.

**Degree**

A Master of Science in Engineering and of Education degree on the second level is received after the completion of the educational programme.

**Conditions for the degree:**

The student must have fulfilled courses corresponding to 300 higher education credits, whereof:

- 45 higher education credits of Mathematics-natural scientific subjects
- 180 higher education credits of subjects central to the technology area (including 30 higher education credits of degree project work)
- At least 90 higher education credits on the second level, whereof at least 60 higher education credits are in subjects central to the technology area (including 30 higher education credits of degree project work)

The following will be discerned from the above credits:

- subject studies and subject didactical courses, including internship programmes corresponding two specialisations with concentrated specialisations within the education programme (180 higher education credits)
- courses in educational science and interdisciplinary courses, including internship programmes corresponding the general education area within educational programmes and degree project work (90 higher education credits)

See more in appendix 2 and 3

**The name of the degree**

Master of Science in Engineering and of Education, Degree Programme in Mathematics and Physics, Mathematics and Computer Science or Mathematics and Chemistry.

**Application for the degree**

The application for the degree is done on a special form and is submitted to the school of Engineering Science’s office. Proof of the paid student union fee must be attached to the application.

See http://www.kth.se/student/examen.

**Appendix 1 Course lists for study years and specialisations**
Appendix 1 - Course list
Appendix 2 - Programme syllabus descriptions
# Appendix 1: Course list

Master of Science in Engineering and of Education (CL), Programme syllabus for studies starting in autumn 2007

## 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>
</tr>
</thead>
<tbody>
<tr>
<td>DD1310</td>
<td>Programming Techniques</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>ED1100</td>
<td>Engineering Science</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KTGA10</td>
<td>Basic Course in Teacher Commission and Professional Teacherhood, incl Teaching Practice</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KTGD10</td>
<td>Educational Perspective on Mathematics, incl Teaching Practice</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SA1000</td>
<td>Science, Technology and Learning I, incl Teaching Practice</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1613</td>
<td>Mathematics 2</td>
<td>12.0 hp</td>
<td>First cycle</td>
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<tr>
<td>SF1623</td>
<td>Mathematics I</td>
<td>15.0 hp</td>
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**Optional courses**

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<tr>
<th>Course code</th>
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<tbody>
<tr>
<td>SF1611</td>
<td>Introductory Course in Mathematics I</td>
<td>1.5 hp</td>
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### Year 2

**Mandatory courses (27.0 Credits)**

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<tbody>
<tr>
<td>DN1240</td>
<td>Numerical Methods, Basic Course II</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1610</td>
<td>Discrete Mathematics</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
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</table>
### Programme syllabus for Master of Science in Engineering and of Education batch autumn 07.

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<table>
<thead>
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<th>Course code</th>
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<tbody>
<tr>
<td>SF1637</td>
<td>Differential Equations and Transforms III</td>
<td>6.0 hp</td>
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</tr>
<tr>
<td>UDK300</td>
<td>Theories of Learning</td>
<td>7.5 hp</td>
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**Year 3**

**Mandatory courses (21.0 Credits)**

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<tbody>
<tr>
<td>SF1905</td>
<td>Probability Theory and Statistics, Basic Course</td>
<td>6.0 hp</td>
<td>First cycle</td>
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<tr>
<td>UBK400</td>
<td>Identity Formation and Socialization</td>
<td>7.5 hp</td>
<td>First cycle</td>
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<tr>
<td>UCK400</td>
<td>Education in School and Society</td>
<td>7.5 hp</td>
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**Year 4**

**Mandatory courses (27.0 Credits)**

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<tbody>
<tr>
<td>SF2717</td>
<td>Mathematics, Advanced Course</td>
<td>6.0 hp</td>
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<tr>
<td>SF2719</td>
<td>The History of Mathematics</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>UMK801</td>
<td>Pedagogical Content Knowledge - in School Service</td>
<td>15.0 hp</td>
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**Year 5**

**Mandatory courses (105.0 Credits)**

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<tr>
<td>KTEX4N</td>
<td>Master's Project in Technology and Learning</td>
<td>30.0 hp</td>
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<tr>
<td>SA210X</td>
<td>Degree Project in Technology and Learning, Second Cycle</td>
<td>30.0 hp</td>
<td>Second cycle</td>
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<tr>
<td>UCK700</td>
<td>Teacher Commission and Professional Teacherhood II</td>
<td>7.5 hp</td>
<td>Second cycle</td>
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<td>UMK900</td>
<td>Degree Project in Technology and Learning, Second Cycle</td>
<td>30.0 hp</td>
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<tr>
<td>UQK700</td>
<td>Challenges for Special Education - Youth and Adults</td>
<td>7.5 hp</td>
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**Mathematics and Information Technology and Computer Science (MADA)**

**Year 2**

**Mandatory courses (37.5 Credits)**

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<tr>
<td>DD1320</td>
<td>Applied Computer Science</td>
<td>6.0 hp</td>
<td>First cycle</td>
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<tr>
<td>DD2377</td>
<td>Low Level Programming and Computer Architecture</td>
<td>7.5 hp</td>
<td>Second cycle</td>
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<tr>
<td>DH1607</td>
<td>Learning and ICT, Project Course</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>DH2605</td>
<td>Science, Technology and Learning, part II, incl Teaching Practice</td>
<td>4.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MF1035</td>
<td>Electrical Engineering, Basic Course Media</td>
<td>6.0 hp</td>
<td>First cycle</td>
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<td>UDK200</td>
<td>Educational Perspective on ICT and Computer Science</td>
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**Year 3**

**Mandatory courses (28.5 Credits)**

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<tr>
<td>DD1334</td>
<td>Database Technology</td>
<td>6.0 hp</td>
<td>First cycle</td>
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<tr>
<td>DH1603</td>
<td>Communication and Media</td>
<td>7.5 hp</td>
<td>First cycle</td>
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<tr>
<td>DH2624</td>
<td>Human-Computer Interaction - a Didactive Perspective</td>
<td>7.5 hp</td>
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<td>SK1131</td>
<td>Physics: Waves and Particles</td>
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**Year 4**

**Mandatory courses (12.0 Credits)**

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<tbody>
<tr>
<td>DD2385</td>
<td>Software Engineering</td>
<td>6.0 hp</td>
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<tr>
<td>MJ2612</td>
<td>Teaching and Sustainable Development</td>
<td>6.0 hp</td>
<td>Second cycle</td>
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</table>

**Conditionally elective courses**

<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>DD1352</td>
<td>Algorithms, Data Structures and Complexity</td>
<td>9.0 hp</td>
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<tr>
<td>DD1361</td>
<td>Programming Paradigms</td>
<td>7.5 hp</td>
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<tr>
<td>DD2354</td>
<td>Algorithms and Complexity</td>
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<tr>
<td>DD2372</td>
<td>Automata and Languages</td>
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<tr>
<td>DD2380</td>
<td>Artificial Intelligence</td>
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<tr>
<td>DD2387</td>
<td>Program System Construction Using C++</td>
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<tr>
<td>DD2388</td>
<td>Program System Construction using .NET Framework</td>
<td>7.5 hp</td>
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<tr>
<td>DD2390</td>
<td>Internet Programming</td>
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<tr>
<td>DD2393</td>
<td>Protocols and Principles of the Internet</td>
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<tr>
<td>DD2395</td>
<td>Computer Security</td>
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<tr>
<td>DD2423</td>
<td>Image Analysis and Computer Vision</td>
<td>7.5 hp</td>
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</table>
DD2427  Image Based Recognition and Classification  6.0 hp  Second cycle
DD2429  Computational Photography  6.0 hp  Second cycle
DD2431  Machine Learning  6.0 hp  Second cycle
DD2432  Artificial Neural Networks and Other Learning Systems  6.0 hp  Second cycle
DD2440  Advanced Algorithms  6.0 hp  Second cycle
DD2441  Seminars on Theoretical Computer Science  6.0 hp  Second cycle
DD2446  Complexity Theory  6.0 hp  Second cycle
DD2448  Foundations of Cryptography  7.5 hp  Second cycle
DD2457  Program Semantics and Analysis  6.0 hp  Second cycle
DD2469  Database Theory  6.0 hp  Second cycle
DD2475  Information Retrieval  9.0 hp  Second cycle
DD2483  Development of Web Applications with Enterprise Java  6.0 hp  Second cycle
DH2320  Introduction to Visualization and Computer Graphics  6.0 hp  Second cycle
DH2321  Information Visualization  6.0 hp  Second cycle
DH2323  Computer Graphics and Interaction  6.0 hp  Second cycle
DH2408  Evaluation Methods in Human-Computer Interaction  6.0 hp  Second cycle
DH2418  Language Engineering  6.0 hp  Second cycle
DH2641  Interaction Programming  6.0 hp  Second cycle
DH2651  Computer Game Design and Advanced Graphics  9.0 hp  Second cycle
DN2221  Applied Numerical Methods, part 1  6.0 hp  Second cycle
DN2222  Applied Numerical Methods, part 2  3.0 hp  Second cycle
DT2112  Speech Technology  7.5 hp  Second cycle
DT2140  Multimodal Interaction and Interfaces  7.5 hp  Second cycle
SF2715  Applied Combinatorics  6.0 hp  Second cycle

Mathematics and Physics (MAFY)

Year 2

Mandatory courses (36.0 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>SG1130</td>
<td>Mechanics I</td>
<td>9.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SI1100</td>
<td>Physics, Basic Course I</td>
<td>9.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>SI1140</td>
<td>Mathematical Methods in Physics</td>
<td>9.0 hp</td>
<td>First cycle</td>
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<tr>
<td>SK1100</td>
<td>Physics, Basic Course II</td>
<td>9.0 hp</td>
<td>First cycle</td>
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</table>

Year 3

Mandatory courses (33.0 Credits)
Course code  Course name                                                                 | Credits | Edu. level |
DH2605    Science, Technology and Learning, part II, incl Teaching Practice          | 4.5 hp   | Second cycle |
EI1260    Electromagnetic Theory, Introductory Course                               | 6.0 hp   | First cycle  |
MJ2612    Teaching and Sustainable Development                                      | 6.0 hp   | Second cycle |
SG1140    Mechanics II                                                              | 6.0 hp   | First cycle  |
SH1009    Modern Physics                                                            | 10.5 hp  | First cycle  |

Optional courses

Course code  Course name                                                                 | Credits | Edu. level |
EI1265    Electromagnetic Theory, Optional Course                                   | 3.0 hp   | First cycle  |

Year 4

Mandatory courses (21.0 Credits)

Course code  Course name                                                                 | Credits | Edu. level |
DH1603    Communication and Media                                                   | 7.5 hp   | First cycle  |
SH2402    Astrophysics                                                             | 6.0 hp   | Second cycle |
UMK201    Educational Perspective on Physics I                                      | 7.5 hp   | First cycle  |

Year 5

Mandatory courses (6.0 Credits)

Course code  Course name                                                                 | Credits | Edu. level |
MJ2411    Renewable Energy Technology                                               | 6.0 hp   | Second cycle |

Mathematics and Chemistry (MAKE)

Year 2

Mandatory courses (34.5 Credits)

Course code  Course name                                                                 | Credits | Edu. level |
DH2605    Science, Technology and Learning, part II, incl Teaching Practice          | 4.5 hp   | Second cycle |
KD1020    Introductory Chemistry                                                    | 6.0 hp   | First cycle  |
<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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</thead>
<tbody>
<tr>
<td>KD1030</td>
<td>Chemical Equilibria</td>
<td>6.0 hp</td>
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<tr>
<td>KE1010</td>
<td>Introduction to Chemical Engineering</td>
<td>10.5 hp</td>
<td>First cycle</td>
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<tr>
<td>UMK202</td>
<td>Educational Perspective on Chemistry</td>
<td>7.5 hp</td>
<td>First cycle</td>
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Optional courses

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<tr>
<td>KE1110</td>
<td>Introductory Course in Chemistry</td>
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**Year 3**

Mandatory courses (33.0 Credits)

<table>
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<th>Course code</th>
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<tbody>
<tr>
<td>KD1040</td>
<td>Chemical Thermodynamics</td>
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<tr>
<td>KD1070</td>
<td>Molecular Structure</td>
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<tr>
<td>KD1080</td>
<td>Chemical Dynamics</td>
<td>6.0 hp</td>
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<tr>
<td>KD1090</td>
<td>Organic Chemistry 1</td>
<td>7.5 hp</td>
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<tr>
<td>KD1120</td>
<td>Analytical Chemistry</td>
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**Year 4**

Mandatory courses (31.5 Credits)

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<th>Course code</th>
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<tbody>
<tr>
<td>BB1050</td>
<td>Biotechnology</td>
<td>6.0 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>DH1603</td>
<td>Communication and Media</td>
<td>7.5 hp</td>
<td>First cycle</td>
</tr>
<tr>
<td>KD2130</td>
<td>Inorganic Chemistry</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2612</td>
<td>Teaching and Sustainable Development</td>
<td>6.0 hp</td>
<td>Second cycle</td>
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<tr>
<td>SF2718</td>
<td>Mathematics for Chemists</td>
<td>6.0 hp</td>
<td>Second cycle</td>
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**Year 5**

Mandatory courses (6.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
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<tbody>
<tr>
<td>KF1040</td>
<td>Polymer Technology</td>
<td>6.0 hp</td>
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Appendix 2: Specialisations

Master of Science in Engineering and of Education (CL), Programme syllabus for studies starting in autumn 2007

Mathematics and Information Technology and Computer Science (MADA)

Mathematics and Physics (MAFY)

Mathematics and Chemistry (MAKE)