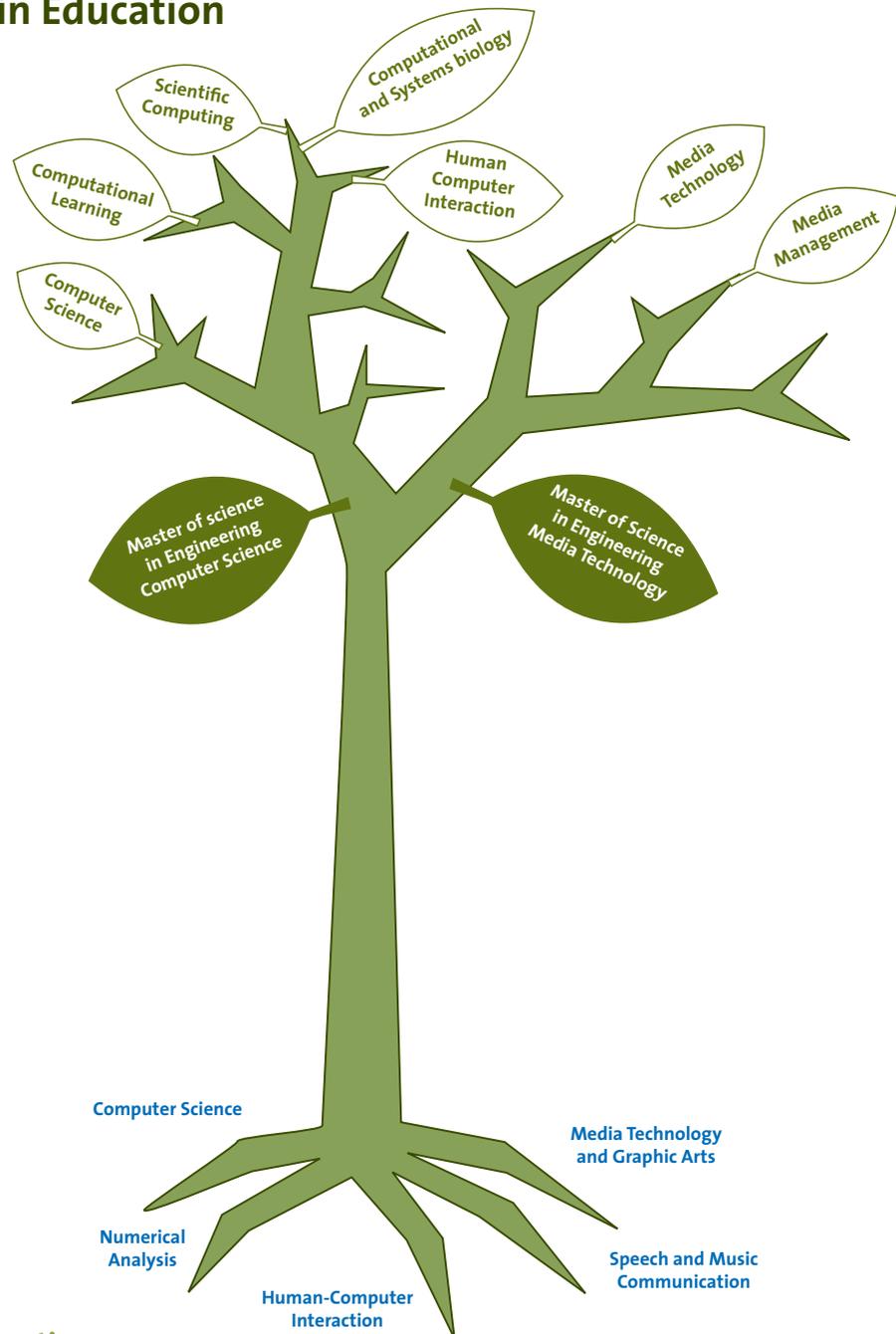


## Development in Education



### Undergraduate Education

During the 1960s and 1970s, the education focused in the undergraduate courses on basic numerical methods and computer programming. Since the 1980s, most degree programmes at KTH have included both a basic course in programming and a basic course in numerical analysis. Today, the School is responsible for more than 200 courses with a total of almost 1400 full-time-equivalent students, including 200 degree projects. The courses cover all Bologna cycles, including Lifelong-Learning. Our main disciplines are scientific computing (25 courses), computer science (70), media technology (30), human-computer interaction (30), speech and music technology (15) and language (40 courses).

CSC offers two Master of Science in Engineering programmes (300 ECTS credits) in Computer Science (since 1983) and Media Technology (since 1999). Both programmes are the most popular in Sweden of their kind when it comes to the number of applicants. The Bachelor-level degree programme (180 ECTS credits) in Media Technology was cancelled in 2008. At Stockholm University (SU), CSC is responsible for a Master of Science and a Bachelor of Science degree programme in Computer Science.

At present, we have adapted the curriculum to harmonize with the Bologna model, but we expect our five-year Master of Science in Engineering programmes to remain as vocational degrees, as selected combinations of Bachelor and Master's programmes.

KTH welcomes students from all over the world and actively encourages our own students to study outside Sweden. This makes language and cultural skills important. Our Language Unit therefore offers a wide range of undergraduate language courses as well as specialized advanced courses.

## Educational programmes

The aim of the Master of Science and Engineering degree programme in Computer Science is to provide engineers with the prerequisites and ability to take part in and lead the assessment, development and introduction of new computer technology. Mathematics and Software Engineering play a major part in the education. During recent years, the programme has been continuously assessed and revised, from first to final year. It has been strengthened e.g. by training in computer security and ethics, to meet the changing needs of technology and society. It is hoped that the introduction of mandatory degree projects for the Bachelor's degree and conversion of the final two years to a Master's programme will improve the time to graduation and increase the chances of international exchanges.

The aim of the Master of Science in Engineering degree programme in Media Technology is to provide engineers with the knowledge and skills to solve problems related to the design and use of media technology and mediated services in various communication situations. The students are prepared for tasks on both the sender and the receiver side, as well as the entire communication process in between. Here, too, a mandatory Bachelor's degree project has been introduced, and the last two years will be a Master's programme. In conjunction with these changes, other parts of the programme have also been revised.

The English one-and-a-half-year Master's programme in Scientific Computing started in 1997. Students from 30 countries have taken part. In 2006, it was extended to a two-year Master's programme. As programme coordinator, we will also run a joint Master's programme Computer Simulation for Science and Engineering with three other European universities within the EU programme Erasmus Mundus.

The Bachelor of Science in Engineering programme in Media Technology is being phased out and the last student intake was in 2007. The one-year Master's programmes in Software Development and Human-Computer Interaction began as one-and-a-half-year programmes and were intended as continuing education. In 2007 they were recast as one-year programmes, but have not attracted a sufficient number of students. The Software Development programme will therefore be discontinued, and the Human-Computer Interaction programme will re-emerge as a two-year Master's programme in the autumn of 2010.

The School's present majors and specializations will be converted to majors in the four new Master's programmes in Computational Learning, Computer Science, Human-Computer Interaction, and Media Technology, which will replace the last two years of the five-year Master of Science in Engineering degree programme. This is planned to start in 2010. Computational Learning will be given entirely in English.

The earlier major in Business Systems and Media Technology (AFM), which was offered to students at both the Stockholm School of Economics and KTH, was replaced in 2007 by a two-year English Master's programme in Media Management, still in cooperation with the Stockholm School of Economics.

The major in Biomedical Engineering was replaced in 2008 by a new two-year English Master's programme in Computational and Systems Biology. We will also run a joint Master's programme, Systems Biology, together with three other European universities within the EU programme Erasmus Mundus.

Over and above the new Master's programmes, we are also planning for a new Bachelor's programme under the working title of Simulation Technology and Virtual Design.

At Stockholm University, NADA teaches in the Bachelor's and Master's programmes in Computer Science and offers stand-alone courses in Computer Science and Scientific Computing. A Bachelor's programme in Scientific Computing was set up in 2007 but discontinued the following year due to lack of applicants. Three orientation courses set up in 2007 were also discontinued for the same reason. We will be deepening our commitment to the Bachelor's programme in Biomathematics. The first step in this direction was taken just before the academic year 2009-2010, when the programme changed its name to Biomathematics and Computational Biology. We are also exploring the possibility of starting a Bachelor's programme in Design of IT Systems for students who have studied the Social Sciences programme at high school level.

Giving the Master's programmes in English will attract more students from abroad with different education traditions, and we are developing our way of receiving and taking care of these students further.

## Course offerings

The School offers courses to all Master of Science in Engineering degree programmes at KTH and to the Science Faculty at Stockholm University. This applies both to those who want to specialize in our fields and those whose majors will be in other fields. The disciplines Computer Science and Media Technology are still relatively new and presuppose that the courses and programmes are continuously adapted to technical developments and their impact of society. The students' varying entry knowledge is a reality that we share with other Schools at KTH. One way in which we address this is to offer web-based preparatory courses in programming. To contribute to the education of the general public, we are considering setting up popular web courses in some of our subjects. These courses may also serve as a preparation for studying at KTH.

The basic courses in Scientific Computing focus on simple ideas and concepts and on numerical methods for solving engineering problems, often modeled with differential equations. Judging the reliability of the result is an important aspect. The basic courses lead up to solutions to realistic computational problems of relevance to the degree programme, which is now possible through modern software. The second-cycle courses offer deeper mathematical theory, a larger methods catalogue and projects with more difficult application problems. Apart from general and specialized courses in numerical methods, courses run jointly with other departments are given in computational methods for fluid mechanics, electromagnetics, material science and molecular dynamics problems. Additionally, courses are offered in computational programming and one course in visualization. Where appropriate, advanced level courses include preparatory items for students with different educational backgrounds, so that the courses suit more students.

In Computer Science, the basic courses concentrate on modern programming techniques with methods such as modularization and abstraction. Large courses also include algorithms, advanced data structures and software development techniques.

Specialization is offered at the moment in the majors, Master's programmes and elective courses linked to the department's research, such as Artificial Intelligence, Computational Biology, Biomedical Technology, Database Technology, Computer Security, Computer Vision and Robotics, Internet Programming, Internet Technology, Computational Learning and Neural Networks, Software Systems Technology and Theoretical Computer Science.

The fields of language technology, graphics and interaction programming, and visualization are shared with the departments for Speech, Music and Hearing, Human-Computer Interaction and Numerical Analysis, partly in line with the thematic platform Human Communication.

In Media Technology, the education deals with technology and methods for the full spectrum of media types and services, from printed communication to interactive digital media. This comprises the study of efficient and innovative use of technology in the media industry and among consumers. In the Master of Science in Engineering programme, the majority of the courses are grouped under the majors Interactive Media Technology, Image and Video Technology, Sound, and Printed Communication. Specializations at Master's level are also offered on the Master's programme in Media Management.

Human-Computer Interaction (HCI) addresses the cooperation between people and computerized technical systems. The School offers courses in HCI at basic and advanced level, along with courses in communication, graphics and language technology. Specialization is offered through several majors, adapted to their respective degree programmes. In particular, different methods are studied for the design of computer support so that the interplay between people and computers is powerful and simple, and computer support for writing, collaboration and media communication

In Speech and Music Communication, the courses range from spectral transforms, audio technology and music acoustics to speaking and listening computers. Most of the courses are elective and are typically taken by students from the programmes in Computer Science, Media Technology, Electrical Engineering and Engineering Physics. The curriculum will be updated to the research edge with a new track for multimodal communication in the Master's programme in Human-Computer Interaction, now in its planning stages. Also, web-based courses in entry-level topics, starting with Music Acoustics, will be developed both as a teaching tool and as part of a student recruitment strategy.

In Language, we offer a broad range of courses in English, German, French, Spanish, Italian, Russian, Japanese, Chinese, Swedish, and Swedish as a Foreign Language. In total, about 130 course modules are given with approximately 3,000 course places a year. There are four different course levels for most of the languages, and a mandatory placement test guides the students to the right course level. The courses at basic level provide students with elementary practical language skills: a certain ability to express themselves in speech and writing and to read general texts. Courses at advanced level focus on technical language to train the students' spoken and written skills in preparation for an international career. The Master of Science in Engineering programmes in Chemistry, Information Technology, Microelectronics and Computer Science all have international majors where the students can supplement their degree with a language certificate comprising 45 ECTS in German, French or Spanish, or 60 ECTS in Chinese or Japanese. The students also have the opportunity to study for one or two semesters in a country where the language is spoken.

# Stage Goals in Three Years' Time 2010-2012

## Undergraduate Education

### Number of applicants per place

At least 1.5 first-choice applicants per place in Master of Science in Engineering programmes.

At least 30 enrolled students per Master's programme,

### Admissions:

At least 25% women in our courses and 20% in our programmes.

### Degree of performance

An examination/course pass rate of at least 85%.

### Annual completed degrees

90 in the Computer Science and Engineering programme and 40 in the Media Technology programme. When all of the Master's programs have been introduced, the total goal is 200.

### Course leaders

At least 80% of the department's courses at advanced level in all technical subjects have course leaders with doctoral degrees.

### Admission requirements

Investigate the possibilities for admission on other than only averaged out grades. If the possibilities seem promising, we will carry out limited trials.

### Follow-up of studies:

Introduce an active and early follow-up of studies to reveal and support students who need extra assistance.

### Pedagogy

Refine the teaching to adapt it to one-hour lectures.

### Teachers' pedagogical skills

Bring in a pedagogical expert for the appointment of all teaching positions.

Investigate the possibility of introducing a pedagogical career path.

### Student culture

Along with the students, influence the student culture so as to increase the focus on studies.

### Contact students/teachers

Evolve a strategy for communication between the School faculty and the students.

### Links to research

Systematically offer interested engineering students from second year onward the chance to take part in and contribute to the work of the School's research groups.

### Fulfilling goals

Appraise the extent to which the student is fulfilling the goals of the curriculum rather than assuming that they have passed certain courses.

### **Finance**

Every subject must pay its way financially, even if each individual course need not.

### **Working environment/Health and safety**

Introduce sabbatical semesters for teachers.

This will affect both the national and the international exchange positively.

### **Research education**

- The number of women admitted will increase to 25% but we are aiming for 30%
- The number of doctoral degrees is maintained at 15-20/year
- Coordinated course offerings advertised with good foresight

### **Research and development**

- Five new professorships created/filled once more with at least one woman professor inaugurated.
- At least five associate professors promoted to professor, of whom at least two are women.
- At least five associate professors recruited, of whom at least two are women.
- At least five assistant professors recruited, of whom at least two are women.
- At least five postdoctoral research fellows, at least two of whom are women, are employed.
- For all teachers, 20% of their time is dedicated to their own development
- All teachers have teaching duties for at least 25% of their time.
- Fifty percent of all teachers are able to devote at least 25% of their time to their own research.

### **Teachers' conditions**

- Create a model whereby we can introduce a sabbatical semester adapted to individual needs
- Create a model for continuous career support
- Revise the staffing model and extend it to cover all activities
- Revise the distribution of administrative duties between teachers and administrators
- Investigate how time studies can be used to support teachers' planning
- Investigate what support systems are available locally and at other universities.

### **Cooperation with the community at large**

- Appoint/employ someone responsible for liaison with companies/ business and industry/ the community at large
- Map out and take care of existing contacts – create a database
- Draw up an action plan to expand contacts with society at large
- Make clear the requirements in every employment profile relating to cooperation with the rest of society

### **Internationalization**

- Draw up an action plan to increase student and teacher exchanges

### **Premises**

All work is done in purpose-built premises. Of the School's total costs, the cost of premises should not exceed 12% for undergraduate education and 10% for research and research education.