

# Teaching

## Undergraduate level



*Sten Ternström, professor  
Director of undergraduate studies*

The undergraduate courses given by the department are aimed primarily at the last two years of the Master of Science (civilingenjör). All courses but two belong to the pool of optional courses from which undergraduate students select courses for their specialisation. The students are mostly from the study programmes Electrical Engineering, Computer Science and Engineering, Media Technology, and Engineering Physics.

The undergraduate teaching activity at the department saw a period of expansion in 2002 which was consolidated last year. For the Media Technology programme, TMH now offers a major/minor four-course package of 20 credits in the general area of Sound, which started operating in the autumn of 2002. It was elected by about 12 out of 65 Media students, which is a

good proportion in view of the many choices that they have. Our package consists of Sound Perception, Audio Technology, Speech Technology, and Musical Communication with Music Technology. Attendance was good, 30-40 students per course, about two thirds of which came from electrical engineering and one third from media engineering.

The course in Media Technology Fundamentals was given in 2003 for the fourth time. This is a large compulsory course for second-year students in the Media Technology programme. It is co-ordinated by the undersigned, and taught by three cooperating departments.

As part of the M.Sc. degree the undergraduates are required to complete a thesis amounting to 4-5 months of full time work. In 2003, 20 students finished their M.Sc. theses at

TMH. These included several visiting students from other universities.

We are currently investigating the feasibility of launching one or two Master programmes in the general areas of speech technology and music technology.

Thanks to a grant from STINT, we have been able to enhance some of our courses with guest lecturers from the Media Engineering Group, Electronics, University of York, UK. Under this exchange programme, we exchange undergraduate and postgraduate students as well as researchers.

The relocation of the Speech Signal Processing group to the S3 department means that their two undergraduate courses are no longer given by TMH.

### **2F1111 Speech technology (4 cr)**

### **2F1112 Speech technology, extended (5 cr)**

18 and 15 students, respectively

*Inger Karlsson*

Elements of linguistics and phonetics applied to speech transmission and communication. Speech signal analysis and processing. Acoustic theory of speech production, implementation in speech synthesis. Auditory functions and perception of speech. Automatic speech recognition and text-to-speech conversion. Speech quality and intelligibility assessments. Automatic speaker verification. Text-to-speech and speech-to-text in systems for human-computer interaction, especially multi-modal dialogue systems.

### **2F1212 Music acoustics (4 cr)**

19 students

*Erik Jansson*

Elements of acoustics including wave propagation, electro-mechanical analogies, strings, membranes, tubes. Fourier transform and elements of auditory theory. Design and function of musical instruments. Musical scales. Elements of room acoustics. Synthesis methods for instrument and voice sounds.

### **2F1213 Musical communication and music technology (5 cr)**

23 students

*Anders Friberg*

(I) The communication chain: Elementary music theory. Establishing musical structure. Representations of emotion. Allusions to motion. The musical context: Concert, background, film music.

(II) Technology: synchronization, randomness. The MIDI standard: notes, controls, Standard MIDI files, General MIDI. Synthesis: sample players, sound libraries, sampling, looping, and physical modelling. Computer tools: sound editors, sequencers, notation editors, Director Musices, samplers, audio analysis.

### **2F1300 Sound perception (5 cr)**

25 students

*Arne Leijon*

The course is about human hearing, i.e., which sounds we can hear, how small differences between sounds we can perceive, and how hearing is affected in the presence of background noise. Particular attention is paid to the perception of speech in different environments and to the perception of distance and direction to sound sources. Methods for measuring auditory perception and for assessing the sound quality of audio systems are described. The implications of hearing impairments and the limitations of technical aids for the hearing impaired are considered.

### **2F1400 Electro-acoustics (4 cr)**

35 students

*Anders Askenfelt*

General theory of sound waves. Auditory functions and perceptual limitations. Analogies between electrical, mechanical, and acoustic systems. Acoustical impedance. Basic equations for electro-mechanical four-terminal systems. Loudspeakers, microphones. Sound-recording techniques. Ultrasound. Measurement techniques.

**2F1410 Audio Technology (5 cr)**

30 students

*Sten Ternström*

Two- and three-dimensional sound reproduction. Surround techniques for cinema versus those for accurate sound field reproduction. A/D and D/A conversion in audio. Studio signal processing. Data reduction methods. Audio system architecture and construction examples. Sound quality assessment. Optical disks as used in audio. Group assignment and four laboratory sessions. This year, a new lab session on Ambisonics surround was added.

**2F1510 Pattern recognition (4 cr)**

31 students

*Arne Leijon*

Classical Bayesian decision theory, signal classification in additive white Gaussian noise, matched filter design, parameter estimation and supervised learning, non-parametric classification techniques, linear discriminant functions, and an introduction to neural network design. These concepts and methods are extended to the classification of pattern sequences using the Hidden Markov Model. Human communication by speech and hearing in the framework of signal classification theory.

**2D1574 Media technology fundamentals (12 cr)**

66 students

*Sten Ternström*

An introduction to media engineering, including text and print, still photography, moving pictures, and sound. The course provides basic knowledge on human visual and auditory perception, techniques and production methods relevant to each medium, requirements for data rates and volumes, and an ability to communicate effectively with specialists in the respective areas. Three departments cooperate on this large course. Ternström is the course coordinator and also teaches the "sound track".

**2F1700 Electrical Engineering Project Management (5 cr)**

16 students

*Inger Karlsson*

In this course, groups of 4-5 first-year students learn to plan, execute and evaluate a minor development project in the way that a consultancy might operate. This course is administered by Industrial Control Systems, and gives all students in Electrical Engineering an opportunity to make contact with department research at an early point in their training. The course made its debut in 2001 and has been much appreciated by students and departments alike. Of some 25 projects, four were done at TMH in 2003.

