

Program curriculum for graduate studies in Speech and Music Communication

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Common guidelines for graduate-level studies at KTH are provided in the KTH local guidelines for graduate-level education. This program curriculum complements the common guidelines with subject-specific regulations.

1. Description of subject and educational goals

The aim of the graduate program in Speech and Music Communication is to give the student a firm and comprehensive understanding of the research field and to prepare the student for self-reliant research activity and for a career in research, development, education and consultancy in various areas of society.

The goal of the PhD degree is, additionally, to give the student the ability to plan, structure and lead such work in a critical and independent way.

This entails that the research student following graduation shall possess the ability to

1. describe and explain theories and empirical results within the area of specialization
2. formulate concrete research questions within the area of Speech and Music Communication
3. employ scientific methods and gain new knowledge through scientific studies
4. critically analyze and evaluate methodology and results from scientific studies of their own and of others
5. present and discuss research results within the scientific community
6. present research in a pedagogical manner outside of the scientific community and within educational contexts
7. judge ethical aspects of research within the area of Speech and Music Communication and act in accordance with these and
8. describe conditions and mechanisms for funding of research

Each of the above listed skills should develop in a natural manner during the supervision process. Courses should facilitate the development of skills described in points 1, 3, 6, and 7. Participation in seminars and journal clubs as well as teaching and participation in conferences facilitates the development of skills described in 1, 4 and 5.

1.1 Scientific subject area

The curriculum for Speech and Music Communication encompasses the scientific study of the human communication process primarily by means of acoustic signals such as speech and music. Also communication through visual signals such as facial gestures and body movements during speech and music is included in the subject. The research field includes descriptions, theories, models and technical systems covering all aspects of the communication chain from production through acoustic transmission and hearing to perception, understanding and experience.

1.2 Definition of study tracks

The curriculum for Speech and Music Communication has two areas of specialization: Speech Communication and Music Acoustics.

2 Description of study tracks

2.1 Speech Communication

2.1.1 Description of Speech Communication

The curriculum for “Speech and Music Communication – Speech Communication” encompasses the scientific study of the speech communication process including applications within information technology, telecommunications, and relevant areas within medicine and aids for the handicapped.

2.1.2 Current research themes

Speech technology including applications of speech communication is under rapid development and has grown into a new interdisciplinary research field with roots in linguistics, speech communication research and computer science. Examples of such research areas are multimodal speech synthesis, speech recognition, speaker verification, multimodal dialog systems and more application-oriented systems and methods related to, for example, language learning and functional disabilities. Any one of these areas comprises a suitable subject for a thesis. Thesis related research is often associated with the Centre for Speech Technology (CTT), a competence centre for cooperation between academia and industry located at the department. Basic research in speech production, acoustics of speech, speech perception and analysis of voice quality is also carried out at the department and can constitute a suitable thesis subject.

2.1.3 Structure of the program

The graduate program can lead to a licentiate or a doctoral degree. The program comprises a total of 120 credits for a licentiate degree and 240 credits for a doctoral degree, and in both cases there is a course part and a thesis part. The course part comprises 35-50 credits for a licentiate degree and 60-90 credits for a doctoral degree. The KTH local guidelines for graduate studies regulate how credits for undergraduate courses can be included in a graduate degree. The reason for any individual deviations to these regulations must be specified in the individual study plan. Undergraduate courses can only be included if they are essential for the individual thesis subject or if they provide a cross disciplinary expansion of the research area.

Deviation from the suggested number of credits can occur in the case of extraordinary circumstances. The courses can be given as lectures, seminars, reading assignments and special projects. Courses taken for credit within the graduate program are to be chosen individually in consultation with the head of the subject area and the main supervisor.

An individual study plan shall be made and updated normally on an annual basis. The study plan shall convincingly show how the goals for the student's graduate studies can be attained within the allotted time.

Graduate students should, during their education, take part in and contribute to the scientific activity at the department by participating in seminars and normally give one seminar every year about their thesis work.

2.1.4 Compulsory and recommended courses

The course part of the graduate program must include elements of philosophy of science and research methodology. It can also include courses oriented towards education and pedagogical methods for university teachers. Such courses are mandatory if the student is engaged in undergraduate teaching during the time of the graduate studies.

The courses Basics of Speech and Hearing (F2F5113) and Theory of Speech Communication (F2F5115) are compulsory for the licentiate or the doctoral degree. Other courses are defined and chosen individually. Some of these courses are described below.

Due to the interdisciplinary nature of the research area, doctoral and undergraduate courses at other universities can be included. Especially courses in Phonetics and Linguistics can often be a good complement to the courses in Speech Communication.

Compulsory Courses

F2F5113 Basics of Speech and Hearing, 15 higher education credits.

Basics of speech and hearing course. Physiology of speech and hearing. Signal representation in various links of the human speaker/listener speech chain. Coding mechanisms.

F2F5115 Theory of Speech Communication, 15 higher education credits.

Theory of speech communication. Information theory, linguistics and phonetics as a theoretical basis for speech communication. The speech code. Special emphasis is placed on aspects of speech communication which have particular importance for automatic speech understanding and speech synthesis.

Recommended Courses

F2F5112 Special Course in Signal and Circuit Theory, 15 higher education credits.

Special course in signal and circuit theory. Signal processing methods for speech analysis and speech recognition. Speech production models.

F2F5114 Advanced Course in Speech and Hearing, 7.5-22.5 higher education credits

Advanced course in speech and hearing. Emphasis on theoretical problems concerning

complexity, variability and interaction. Auditory transformations in relationship to the speech signal.

F2F5116 Advanced Course in Speech Communication Theory, 7.5-22.5 higher education credits. Advanced course in speech communication theory. Text analysis, parsing, lexical access. Relationship between prosodic and segmental features. Speaker-specific features and speaking style variations.

F2F5117 Speech Communication Systems, 15 higher education credits. Speech communication systems. The use of speech communication models in speech technology systems, e.g. speech-based dialogue systems. Design criteria and performance. Evaluation of speech intelligibility and speech quality. Effect of room acoustics and constraints in the ability of the speaker/listener. Applications within information technology, telecommunications, education, and aids for the handicapped.

2.2 Music Acoustics

2.2.1 Description of Music Acoustics

The curriculum for “Speech and Music communication – Music Acoustics” encompasses the scientific study of the musical communication process: composer - musician - listener.

2.2.2 Current research themes

Research and related applications lie primarily within the following areas: music instrument analysis and design, vocology, music informatics, music technology, audio reproduction, non-verbal communication through sound, and music and voice pedagogy. Central subjects comprise theories for sound generation in musical instruments (including the singing voice) and models of music perception. The structuring of sound sequences on several levels in the music communication chain is another important subject area. Music acoustics is thus a markedly interdisciplinary field. The graduate program in Music Acoustics shall lead to a deepened understanding of music as both an acoustic and psychological phenomenon.

2.2.3 Structure of the program

The graduate program can lead to a licentiate or a doctoral degree. The course part comprises 35-50 credits for a licentiate degree and 60-90 credits for a doctoral degree. The KTH local guidelines for graduate studies regulate how credits for undergraduate courses can be included in a graduate degree. The reason for any individual deviations to these regulations must be specified in the individual study plan. The courses can be given as lectures, seminars, reading assignments and special projects. Independent literature studies comprise the most important part of the course work and are to be chosen individually in consultation with the main supervisor.

An individual study plan shall be made and updated normally on an annual basis. The study plan shall convincingly show how the goals for the student’s graduate studies can be attained within the allotted time.

Graduate students should, during their education, take part in and contribute to the scientific activity at the department by participating in seminars and normally give one seminar every year about their thesis work.

2.2.4 Compulsory and recommended courses

The course part of the graduate program must include elements of philosophy of science and research methodology. It can also include courses oriented towards education and pedagogical methods for university teachers. Such courses are mandatory if the student is engaged in undergraduate teaching during the time of the graduate studies.

The courses Acoustics (F2F5210), Auditory Perception (F2F5211) and Room Acoustics (F2F5205) are mandatory for both licentiate students and doctoral students. The additional courses are individually defined and selected.

Compulsory Courses

F2F5210 Acoustics, 7.5-15 higher education credits.

The main areas of classical acoustics: the wave equation, vibrations in strings, pipes, membranes, rods and plates.

F2F5211 Auditory perception 7.5-30 higher education credits.

Physiology of hearing, perception, the representation of signals in the peripheral auditory system, binaural hearing and localisation.

F2F5205 Room acoustics 7.5 higher education credits.

Sound fields in rooms, ray tracing, wave-theoretical and statistical models.

Elective courses

F2F5212 Instrument acoustics 7.5-30 higher education credits.

The acoustic functioning of the classical musical instruments: excitation principles, feedback in resonator systems, radiation properties.

F2F5214 Musicology 7.5-15 higher education credits.

Fundamentals of harmony, counterpoint and elementary composition.

FDT3230 Statistical methods for the behavioural sciences 7.5-10 higher education credits.

Basic statistics, categorical data, tests of means, correlation and regression, analysis of variance, multiple regression.

Other elective courses can be added as seen fit.

2.3 Thesis

The thesis (licentiate or doctoral) should be initiated immediately after acceptance into the program. The subject should be selected in consultation with the head of the subject area and the main supervisor and should be related to the ongoing research at the department.

The thesis (licentiate or doctoral) is an obligatory part of graduate studies. The aim of this part of the graduate study program is that the student shall develop the capacity to independently contribute to research as well as developing the ability to undertake scientific collaboration within and outside of the student's own subject area. The thesis (licentiate or doctoral) shall contain new scientific results that the student has developed alone or in collaboration with others. The main scientific results shall be of the quality required for publication in internationally recognized refereed journals. The student's own contribution to texts in a thesis having several authors shall be separately defined.

The licentiate and doctoral thesis shall normally be written in English. It can consist of a number of appended peer-reviewed papers or a monograph. In the former case, there must be a specially written summary article. In either case, international publication of results should be strived for during the period of graduate studies.

3. Prerequisites and admission

To be accepted as a graduate student, the applicant must fulfil the basic and special requirements and prerequisites and have such general competence as is needed to complete the education.

3.1 General and special prerequisites and prior competence

Basic requirements are defined by the general requirements established by the Swedish National Agency for Higher Education and KTH.

3.1.1 Special Prerequisites: Speech Communication

To be admitted as a graduate student in "Speech and Music Communication – Speech Communication", the applicant must have the prerequisites corresponding to the civil engineering degree in the engineering sciences of electronics, computer science or physics. Applicants can also qualify if they have obtained the corresponding knowledge and skills relevant for studies on the graduate level normally comprising 240 higher education credits or the equivalent.

To be admitted as a doctoral student the applicant has to have knowledge corresponding to the course Speech Technology, DT2112.

Recommended prior competence

A background which includes interest in languages and linguistics and experience in acoustics and signal processing is recommended.

3.1.2 Special Prerequisites: Music Acoustics

To be admitted as a graduate student in "Speech and Music Communication – Music Acoustics", the applicant has to have taken the course Music Acoustics (DT2212) or the course Musical Communication and Music Technology (DT2213). Applicants can also qualify if they have obtained the corresponding knowledge and skills relevant for studies in music acoustics on the graduate level.

Recommended prior competence

In the graduate program it is assumed that the student is familiar with music through active amateur musicianship (instrumental and/or vocal). The student should also have taken two of the following courses: Speech Technology (DT2112), Electroacoustics (DT2400), Sound Perception (EN2100), Audio Technology (DT2410), or other D-level courses in technical acoustics, phonetics, computer science, linguistics or musicology.

3.2 Rules for selection and admission

A selection is made among those applicants that fulfil the requirements. The level of the applicant's maturity, independent judgement and critical analysis are important factors in the selection process. Special emphasis is placed on earlier results in advanced undergraduate courses or independent work such as thesis work. Furthermore the head of the subject or a selected teacher must have accepted the responsibility to supervise the student.

4. Degrees and exams within the program

4.1 Licentiate and Doctoral degrees

The licentiate and doctoral degree examination is carried out according to the general rules established by KTH.

4.2 Exams within the program

No other exams are required in the program.