



# **MASTER'S PROGRAM IN ELECTRONICS/TELECOMMUNICATIONS**

## **INTRODUCTION**

This program is a two-year program adjusted to the Bologna model for European academic studies, which is officially introduced in Sweden from the Autumn 2007.

The program is leading to a Swedish Master's degree named *Teknologie masterexamen*, which is formally translated to *Degree of Master of Science with a major in Electrical Engineering, specialized in Telecommunications*. The emphasis is put on radio frequency measurements, microwave engineering, and signal processing with a focus on hardware design. The aim of the Master's program is to give high-level knowledge in the field, based on a previously achieved Bachelor's degree in Electronics, Electrical Engineering, or equivalent. Thus, the student is presumed to be well prepared in Electronics and other related topics before starting the curriculum. The program is aimed to make the student well qualified for high-level engineering in telecom industry as well as to give formal and appropriate qualification for Ph.D. studies in the field.

The program is based on courses of limited length. All courses and guidance are given in English, and so is the literature. Hence, there is no need whatsoever for any knowledge in the Swedish language.

The academic level of the program courses are divided into basic-level and advanced-level courses. A majority of the program courses are, thus, advanced-level courses which can be interpreted as the *Master's level*.

By means of a Master of Science degree in Electronics, the formal prerequisites for post-graduate (Ph.D.) studies are fulfilled. UG is offering post-graduate programs to a limited number of students within the area of RF and radio communication technology. The post-graduate education is conducted and supervised by UG, but due to Swedish legislation the Ph.D. degree is formally issued by a supervising university.

## **CURRICULUM**

The curriculum is planned as full-time studies, built on courses normally given in pairs (parallel studies). An exception is the thesis work, which is performed after the regular courses. To fulfill the master exam in Electronics/Telecommunications at UG, subject-specific studies of at least 93 ECTS on the advanced level, i.e., the Master's level, are required. For the program in mind, these requirements are met by the following courses: Microwave Engineering I, 10.5 ECTS; Microwave Engineering II, 7.5 ECTS; Antenna Engineering, 7.5 ECTS; Statistical



Signal Processing, 7.5 ECTS; Solid-State Electronics, 7.5 ECTS; Modulation and Coding, 7.5 ECTS; Radio Systems, 7.5 ECTS; Project Course, 7.5 ECTS; and, of course, the Master's Thesis 30 ECTS.

The rest of the program is filled up with relevant basic-level courses for the specialization, in Physics, Mathematics, and Electronics. The curriculum is shown in Table 1. All courses and guidance are given in English, and so is the literature.

Table 1. The curriculum.

	Period 1	Period 2	Period 3	Period 4
Year 1	RF Measurement Technology, Basic level ECTS 7.5 credit units	Microwave Engineering I, Advanced level ECTS 10.5 credit units	Stochastic Processes Basic level ECTS 7.5 credit units	Solid State Electronics, Advanced level ECTS 7.5 credit units
	Fields and Waves, Basic level ECTS 7.5 credit units	Cellular Radio Systems, Basic level ECTS 4.5 credit units	Antenna Engineering, Advanced level ECTS 7.5 credit units	Statistical Signal Processing, Advanced level ECTS 7.5 credit units
	Modulation and Coding, Advanced level ECTS 7.5 credit units	Radio Systems, Advanced level ECTS 7.5 credit units	Master Thesis, Advanced level ECTS 30 credit units	
	Microwave Engineering II, Advanced level ECTS 7.5 credit units	Project Course, Advanced level ECTS 7.5 credit units		

Since the Master's program is leading to qualification for Ph.D. studies, the academic level of the program is certified. However, in order to reach this level in practice, requirements are put on your Bachelor's degree regarding both depth and fundament. A considerable depth in Electronics is the prerequisite for the Master's program, but sufficient knowledge in Mathematics, Physics, and Computer Science is also assumed.

The Master's thesis is on the advanced level, which means that the task should be performed using a scientific approach. Hence, it is most likely that the student will be part of a research team during the period dealing with a limited task of interest in a larger scientific context. If the task is well performed, the thesis might be the starting point of Ph.D. studies, where research is a dominating ingredient. The cooperation between UG and telecom companies is vouching for interesting thesis assignments, although interesting assignments may be found elsewhere worldwide.

## ***COURSES AND MASTER'S THESIS***

The courses are normally based on lectures, exercises, laboratory work, and projects. As a rule, presence is voluntary. At certain occasions, however, personal presence is mandatory, e.g., at scheduled laboratory work.

For good study results, a rule of thumb is stating that at least an equal amount of self-tuition should poise the scheduled activities. In Science and Technology this rule of thumb is of particular importance, due to the close interplay between theoretical understanding and skills typical for these disciplines.

Examination of the students is performed after each course. This is normally performed using written tests and/or some kind of assessment tasks. However, oral examination is sometimes used. If laboratory work is part of a course, this part is treated as a course itself, and the results should be individually approved before the entire course can be considered as passed. For approved results of a course, the following marks are used: A, B, C, D, and E. The mark E is equivalent to “Pass”, whereas A, B, C, and D are denoting honors levels.

Non-approved results cannot be final. A Swedish university degree certificate may not include any “Fails”. Hence, new examination occasions are available some time after the regular examination. Normally, there are in total three examination occasions each year for each course.

The Master's thesis is normally performed in relevant industry, academic institutions, institutes, or equivalent. The thesis assignment is supervised by a scientifically skilled supervisor at location, and, if needed, also by additional (technical) supervisors. It is the obligation of the student to find and negotiate the thesis assignment as part of the course.

## ***AFTER GRADUATION***

With an M.Sc. degree in Electronics, specialized in Telecommunications, combined with the previously gained B.Sc. degree in Electronics/Electrical Engineering, an outstanding engineering qualification is achieved opening brilliant job options for a career in the most intriguing technical professional branch of the 21<sup>st</sup> century.

There is a variety of work options beside the traditional positions. The qualifications achieved by education combined with personal interests and character may place yourself in a company as developer and technical designer, innovator, etc. Your qualifications are of course also sought after for somewhat softer areas like journalism and telecom analytics.

Academically, there are possibilities to continue the scientific career as a Ph.D. student, either at UG or elsewhere in the world. In Sweden, electronics experts holding a doctors degree are rarely found but highly esteemed.



## **PREREQUISITES**

The knowledge entrance requirements for the program are:

- A Bachelor's degree in electronics or corresponding degree.
- Relevant courses in electronics must be included in the exam (individual evaluation).
- At least 30 ECTS in Mathematics and one passed course in signal processing.

## **MASTER OF SCIENCE CERTIFICATE**

Upon graduation, students are awarded the degree *Master of Science with a major in Electrical Engineering, specialized in Telecommunications* (sv. "Teknologie masterexamen inom huvudämnet elektronik med inriktning mot telekommunikation"). Swedish Engineering education is approved by the European FEANI commission.

## **APPLICATION**

**Next program start will be in August/September 2008**

**Last date for application is Feb. 1, 2008.**

All applications to higher education in Sweden must be made online at:

[Swedish National Agency for Higher Education, www.studera.nu/english](http://www.studera.nu/english) (See website for more information).

### **Important dates:**

- Online service will open: December 1
- Last date for applying: February 1
- Last date for submitting documents: February 15
- Last date for submitting English test results: March 15
- Notification of admission ([www.studera.nu/Your pages](http://www.studera.nu/Your pages)): April 15

Also see: [Admission and application procedure](http://www.hig.se/sa/antagn/admission.html) (<http://www.hig.se/sa/antagn/admission.html>).



## **QUESTIONS**

Questions regarding the program are answered by:

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## **FOREIGN STUDENTS**

For foreign/international students the financial situation has to be solved in order to get a student visa. Swedish Migration authorities require proof of that you can support yourself during the planned study period, by means of e.g. bank assets, sponsor's guarantee, scholarships or student benefit from your country of origin/domicile. For further information please consult <http://www.migrationsverket.se/english.html>.

The Master's program does not involve any tuition fees. However, students in Sweden have to supply their own living expenses and accommodation, cost for study literature, compendia, and similar study material. A small student-union fee is mandatory.

Usually, skills in Swedish are requested, but exemptions are granted for education given in English. On the other hand, you must have skills in English, both written and oral, documented by means of an internationally approved examination, such as TOEFL (see [www.studera.nu/english](http://www.studera.nu/english)).

## **SCHOLARSHIP FOR FOREIGN STUDENTS**

The Swedish Institute ([www.si.se](http://www.si.se)) is offering scholarships to foreign students of any nationality. These grants are sufficient to cover living expenses while studying in Sweden. Your application for scholarship should be sent to UG together with your application for admission to the Master's program. Do not apply for scholarships directly to SI.

There is no specific application form for an SI scholarship. You have to express clearly (on your application form for admission to the program, and in a separate letter) that you wish to apply for an SI scholarship.

As soon as we receive your application, together with all necessary documents, you will be considered a candidate for SI scholarship. By the time we inform you about admission to the program, we will also let you know whether you have been granted an SI scholarship.



There might also be other possibilities of external scholarships, either through Swedish benefactors or EU organizations. However, no general scholarships are available through UG.