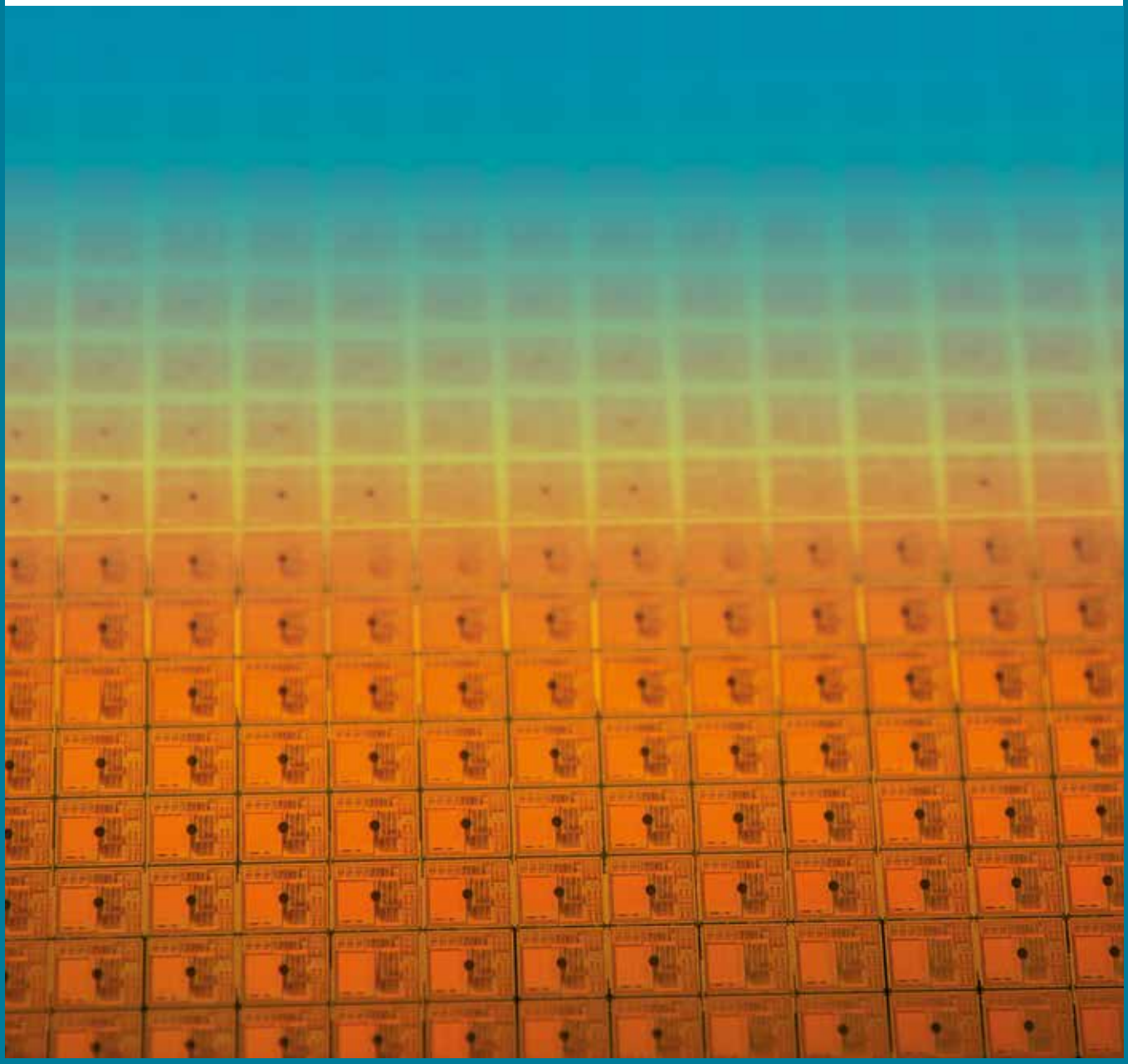
ETH zürich

Department of Information Technology and Electrical Engineering

Master

Electrical Engineering and Information Technology



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Welcome

Electrical engineers continue to invent and to shape the future of the digital world. Electrical engineers create “the smart stuff” in cell phones, computers, cameras, automobiles, robots, medical laboratory equipment, and tons of other things. And they invent the electrical future of sustainable energy.

The Department of Information Technology and Electrical Engineering of ETH Zurich is proud to offer a master program that brings students to the forefront of the field. The Master in Electrical Engineering and Information Technology is the modern version of the classical “Electrical Engineer ETH” and the normal continuation of our bachelor program; it is also the preferred path towards a PhD degree at our department for students from outside ETH.

Each student has a tutor (a professor), who helps with the selection of courses. The courses and projects permit a specialization in one of the following areas:

- Communications
- Electronics and Photonics
- Computers and Networks
- Systems and Control
- Energy and Power Electronics.

However, courses can be selected freely, subject to approval by the tutor.

Courses are offered in English, and the master degree can be obtained without any knowledge of German.

Curriculum Structure

The master program is a full-time study program for 3 to 4 semesters. The program consists of courses, two semester projects, and a master project. All the courses and the two semester projects are usually completed in two semesters. The master project takes additional six months (fulltime). At least 90 credit points ECTS must be acquired. (One credit point corresponds to 25-30 hours of work). Each student must find a tutor (a professor of the department) and have the course selection approved by the tutor not later than four weeks after the beginning of the first semester.

Most of the examinations take place in January/February and in August (between semesters).

Courses (at least 42+2 credit points)

Courses can be selected freely, subject to approval by the tutor. A typical full-size course gives 6 credit points. The courses and their credit points are listed in the course catalogue (www.vvz.ethz.ch).

At least 2 credit points must be obtained by courses from the Department of Humanities, Social, and Political Sciences (D-GESS).

Two Semester Projects (8 credit points each)

The two semester projects give students some hands-on research experience and the opportunity to improve their experimental and/or programming skills. Each semester project should take about halfof a student’s time during one semester. (It is possible to do a semester project in 7 weeks full-time outside a semester, but it is not recommended.)

The projects are offered by the individual laboratories of the department.

Master Project (30 credit points)

The master program culminates in the master project (6 months full-time). All other parts of the master program should be completed before the beginning of the master project.

The projects are offered by the individual laboratories of the department.

‘We are working on cutting-edge solutions to the complex challenges that will confront our world in the fields of information and communication, electronics and photonics, energy, and health.’

Prof. John Lygeros, Automatic Control Laboratory, D-ITET

Areas of Specialization

Communications

Telecommunications is about transmitting "information" from "here" to "there" over wires, optical fibers, or by means of electromagnetic waves in free space. The challenge is to do this efficiently and reliably despite disturbances and imperfections of the medium.

The design of modern communication systems is firmly based on the fundamental principles of information theory that were discovered by Claude Shannon and that continue to be a vibrant research area by themselves.

The exploitation of these ideas has been enabled both by the amazing progress in semiconductor technologies and by ever more sophisticated statistical signal processing. Indeed, as one of the largest industries, communications has been driving forward both semiconductor technologies and methods for signal processing.

The courses and projects in this area cover fundamentals and applications in communication systems, information theory, electromagnetic wave propagation, and signal processing.

Electronics and Photonics

All the "smart stuff" of our digital world is embodied in semiconductor electronics. Modern VLSI (very large scaleintegration) chips contain fantastic numbers of transistors, and the design of such chips is both an art and anever growing challenge.

Many things need to be understood: semiconductor physics, circuits, computer architectures, design and simulation of very large systems, manufacturing, and testing. When all this is mastered, the chip designer can create almost everything.

Of special interest are also the sensors and circuits at the interface between the real world and the digital world, including, in particular, optoelectronic devices for imaging and for communications.

The courses and projects in this area cover both fundamentals of electronics and photonics as well as VLSI design at the forefront of technology.

Computers and Networks

Computers are inside everything nowadays, and many gadgets (including cell phones, laptop computers, cars etc.) actually contain several special-purpose computers. How to design such "embedded" computers and how to make them talk to each other and to the internet are key issues in the digital world.

Additional challenges arise if computers are connected by wireless networks, especially if the computers are inside moving things. How can we reliably distribute data across, or aggregate data from, such a shaky network?

And then there is the threat of malicious hackers, which is driving intense research in cryptography and system security.

The courses and projects in this area cover the fundamentals of embedded computers and their communication toeach other and the internet, including the challenges of wireless networks and security issues.

Systems and Control

The mathematical theory of dynamical systems studies the behavior of physical systems (mechanical, electrical etc.) over time. Control theory is a branch of systems theory that deals with regulating the dynamics of a system in some desired way using on-line measurements. Classical applications of control theory include aviation, chemical plants, and electrical power distribution networks. More recent applications include traction control and cruise control in automobiles, active suspension systems, traffic control on the internet, collective power control for wireless phones, and much more.

The courses and projects in this area range from the theoretical foundations of systems theory, to algorithms and computer tools for solving practical control problems, to applications in industrial processes, robotics, embedded systems, automotive systems, and biology.

Energy and Power Electronics

The generation and the distribution of electrical energy, and its use in electrical motors and other appliances, marked the very beginning of electrical engineering. Impending changes in the power industry and the needs of sustainable energy are moving these topics center stage once more. More efficient converters and motors of all sizes (up to large-scale power plants and down to micro mechanics) are needed. Suitable control policies for the coexistence of small local power generators, large power stations, and new types of loads such as electrical vehicles must be developed. Novel power electronic devices, new materials, and state-of-the-art information technology offer opportunities for new solutions to these challenges.

The courses and projects in this area cover both the fundamentals and applications of the generation and the distribution of electrical energy and will prepare the students to shape the future of electrical power systems and mechatronics.

Prospective Students

How to apply

Students with a bachelor degree from our department are admitted without formal application; the electronic registration (www.mystudies.ethz.ch) suffices.

All other candidates must submit an application. Candidates should have a bachelor degree in electrical engineering from a recognized university or from a Swiss university of applied sciences. All applications will be subject to individual evaluation. For successful applicants additional courses may be required from our bachelor program (up to 60 credit points ECTS). Please refer to the Admissions Office (www.admission.ethz.ch).

Tuition and Cost of Living

The tuition fee is only 580 Swiss Francs per semester. However, students need to budget about 20,000 Swiss Francs (20,000 Euro) per year for living in Zurich (accommodation, subsistence, health insurance, etc.).

A very limited number of scholarships are available for applicants with outstanding academic records.

For more detail see www.ethz.ch/en/studies/financial.

Continuing with Doctoral Studies?

Good master students may consider continuing their studies towards a PhD degree. PhD students are generally well paid. Applications should be made directly to a professor.

Department of Information Technology and Electrical Engineering

The Department of Information Technology and Electrical Engineering of ETH Zurich is active at the forefront ofresearch throughout the broad area of electrical engineering, ranging from wireless communications to electronics and from control theory to computers inside things. In addition, the department has a strong bioengineering section. The department is committed both to basic research and to applied research, and countless collaborations with industry are a matter of course. The faculty of the department consists of about 25 professors, who are organized into 11 laboratories („institutes“) with over 300 PhD students in total. The facilities both for research and for teaching are excellent. Each year the department awards 100 to 150 bachelor degrees and about the same number of master degrees.

Student Life

Zurich is consistently rated as one of the best places in the world to live. The city is situated on the beautiful lake of Zurich with the mountains less than an hour away. Zurich is relatively clean and safe and has an excellent public transportation system and a high standard of living. The city has an international flair and offers many cultural activities as well as a vibrant nightlife. Most Swiss are multilingual and English is often the language of choice. Although German is not required for the Master program, some knowledge will make navigating the city and the university much easier. Language courses for students are available at: www.sprachenzentrum.uzh.ch ETH Zurich itself offers a wide variety of sports, music, recreational and continuing education opportunities.

An overview can be found at:
www.ethz.ch/en/campus

Brochures on every topic of life in Zurich are available in English at: www.welcome.zh.ch

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