

스웨덴 · 핀란드의 공학교육

외국 공학 교육 제도 (6)

1. Sweden

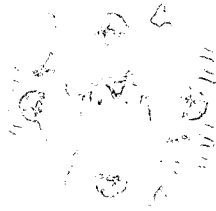
1.1 Higher Education in Sweden

Higher education in Sweden is divided into undergraduate education and postgraduate education and research. Undergraduate courses are available in established first degree programmes and as separate subject courses, which may be combined into a programme leading to a degree as well. Furthermore, the separate subject courses allow for the composition of customised degrees. First degree programmes vary in length from 3 to 5 1/2 years. Each programme consists of courses and sub-courses of varying length.

The academic year consists of two semesters, an autumn semester and a spring semester. The autumn semester begins on September 1 and ends in mid-January; the spring semester begins in mid-January and ends in early June. A break of approximately three weeks occurs at Christmas and one week at Easter. There is no other calendar valid for the whole University as far as dates for breaks, exams, etc. are concerned, since the departments have considerable freedom to decide on these matters themselves.

The Swedish educational system has undergone a continuing series of transformations since the 1950s. A nine-year comprehensive compulsory school and an upper secondary school which integrates theoretical and vocational study programmes have gone into operation, and adult education has been expanded. Practically all post-secondary education, i.e. all university-type education as well as non-academic colleges for different kinds of professional education and training, was incorporated into a single system in 1977. Swedish post-secondary education contained a strong element of national planning and regulation; the aims and length as well as the location and financing of most study programmes were laid down by Parliament. Until 1989 the central government also established the curricula





for all the general study programmes.

In 1991 a major reform was initiated, aiming at a deregulation of the higher education system, greater autonomy for each institution of higher education and a wider scope of individual choice for students. The reform was adopted by Parliament in 1992 and in 1993 a new Higher Education Act came into effect. In the new system the sizes of different programmes and the allocation of grants between institutions will be influenced by the demands of the students and the achievements of each institution in terms of both quality and quantity. The organisation of study and range of courses on offer are determined locally. Students have been given increased freedom of choice regarding study courses within the framework of a new internationally valid Degree Ordinance. Slightly more than 30% of young people in Sweden go on to higher education within five years after completion of their upper secondary schooling. First-time enrollments every year total about 65,000. In 1996/97, the number of students enrolled in undergraduate studies was about 300,400 (57% women) and for post-graduate studies about 17,000 (37% women), making a total of about 317,400 (full-time and part-time students). In the field of technology, the number of students in the undergraduate is 13% (including 25% of female students). The number of students in the graduate level is 28% (including 24% of female students). Distance learning, mainly in the form of correspondence courses, has a long tradition in Sweden. Today most universities and other institutions of higher education offer varying amounts and types of studies on this basis. The courses are designed to meet the educational needs of both individuals and the country. They are planned in such a way as to enable people to pursue their studies unencumbered by place of residence, work or family situation. The emergence of new distance-bridging technologies such as the personal computers, fax machine, interactive video and picture telephone is creating new opportunities for distance learning and making it a high-priority development field.

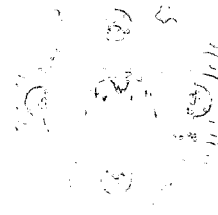


1.2 The organisational structure of Swedish higher education

In Sweden almost all higher education institutions, except for the University of Agricultural Sciences which is under the jurisdiction of the Ministry of Agriculture, Food and Fisheries, fall under the responsibility of the Ministry of Education and Science. Most of the institutions are thus run by the central government. The employees at these universities and university colleges are national civil servants.

Eight of these central government-operated higher education institutions are universities of Uppsala, Lund, Goteborg, Stockholm, Umeaa, Linkoping, Lulea University of Technology, and the University of Agricultural Sciences and two are specialized institutions of higher education and research : the Karolinska Institute (medicine) and the Royal Institute of Technology.





1.3 General degrees

There are two kinds of first degrees: general degrees and professional degrees. The professional degrees are awarded upon completion of studies varying length leading to specific professions. Three general degrees can be obtained at undergraduate level: magisterexamen (Master' s degree) awarded after attaining a minimum of 160 points including a major of 80 points(4 years of full-time study); kandidatexamen (Bachelor' s degree) awarded after attaining a minimum of 120 points including a major of 60 points(at least 3 years of full-time study); and hogskoleexamen (Diploma) awarded after studies amounting to not less than 80 points(2 years of full-time study).

Alongside these general degrees there are a number of professional degrees awarded graduates in for instance Medicine, Engineering and Teaching Professions. Postgraduate education leads to a licentiate degree, representing two years of study, and/or a doctorate, which takes at least four years to complete.

1.4 Post-Graduate Education

Post-graduate education is provided at the universities (Uppsala, Lund, Goteborg, Stockholm, Umeaa and Linkoping) as well as at the Royal Institute of Technology in Stockholm, the Karolinska Institute in Stockholm, the Stockholm School of Economics, Chalmers University of Technology in Goteborg, Lulea University of Technology, and the University of Agricultural Sciences in Uppsala.

Post-graduate studies are financed out of the research appropriation to which each university faculty is entitled. The faculty board can decide to spend the money either on posts (assistantships) for post-graduate studies or on fellowships, both running for four years. A fellowship can also be divided between two graduate students. A student who has succeeded in obtaining a post must concentrate on his or her research studies but can to some extent combine it with teaching or other types of work. The fellowship-holder may combine studies with a job on a research project or a part-time job as a teaching or administrative assistant.

1.5 Some Engineering Universities

- Chalmers University of Technology (Goteborg)

Education and research takes place on a scientific basis at the University's 80 departments. The departments are normally led by a head of department.

The departments are organised into eight schools, corresponding to the main areas of engineering. In addition, there is the School of Environmental Science which does not have its own departments. The Schools of Mathematical and Computing Sciences, Physics and Engineering Physics and Environmental Sciences are run



jointly with the Faculty of Science at Goteborg University. There is also close co-operation with Göteborg University in chemistry. The Schools have School boards which are responsible on a strategic level for the planning of the MScEng and MArch courses, research and doctoral programmes. The dean and the deputy dean are responsible for the management of the School.

-University College of Boras (UCB: Hogskolan I Boras)

The UCB consists of six academic Schools: Swedish School of Library and Information Studies, School of Business and Informatics, School of Education and Behavioural Sciences, School of Engineering, School of Textiles, School of Health Care

Faculty and students at the School of Engineering have a unique resource to use and cooperate with in the Swedish National Testing and Research Institute which is located in Boras.

-Linkoping University

Trying new fields, walking new paths - a non-traditional cooperation across subject and faculty borders is the interdisciplinary approach that has become a hallmark of Linkoping University. An entrepreneurial spirit of education has marked much of the university's short history. Since its foundation in the 1960's, the university has established itself as an innovative and modern institution in both education and research. The university was first founded as an independent college and in 1975 officially became what it is today with the three faculties: Institute of Technology, Faculty of Arts and Sciences and Faculty of Health Sciences. Linkoping University is notably the youngest of Sweden's six universities.



+An interdisciplinary touch

+Multidisciplinary departments

+Problem-Based Learning

+An international setting

-Lulea University of Technology

Lulea University of Technology was established when the former university college in Lulea became the first such college to attain the status of university of technology. Lulea University of Technology is the only University of Technology with such broad scope in its education and research. We conduct research within the Faculty of Engineering and the Faculty of Arts and Sciences. We provide education in the spheres of engineering, the social sciences, the humanities, teaching, the health sciences, music, media education, and drama. It has about 10,000 students enrolled and a staff of 1,350. In addition to the main campus in Lulea, another 4 campuses are existed.

Lulea University of Technology performs research in engineering, the humanities, and the social sciences, in





about 60 divisions belonging to over 15 departments. Most of the projects in progress can be classed as applied research. Our research is characterised by interdisciplinary co-operation within the university and by close collaboration with trade & industry and society.

-Lund University

Lund University, with eight faculties and a number of research centres and specialized institutes, is one of the largest unit for research and higher education in Scandinavia. The main part of the University is situated in Lund, but a number of departments for research and education are located in Malmo and Helsingborg.

Lund University was founded in 1666, partly in order to knit closer to Sweden the provinces which had been ceded by Denmark in 1658. Since then, the University has developed into a modern international centre for research and higher education.

At present, more than 34 000 students are enrolled at Lund University and altogether some 6000 people are employed.

Lund University is divided into eight faculties including technology and The Lund Institute of Technology. The Faculty of Technology covers the following areas of engineering: Engineering Physics, Electrical Engineering and Computer Science, Industrial Economics, Mechanical Engineering, Civil Engineering, Environmental Engineering and Chemical Engineering as well as Architecture, Surveying and Industrial Design. The Lund Institute of Technology (LTH) carries out teaching and research in a broad field of engineering subjects and architecture. Research covers basic engineering, scientific and mathematical subjects, as well as applied subjects.

-Royal Institute of Technology(KTH)

Kungl Tekniska Hogskolan(KTH) provides one-third of Sweden's capacity for engineering studies and technical research at post-secondary level. KTH has nearly 11,000 undergraduate students, 1,400 active postgraduate students and a staff of 3,100 people. KTH conducts top-notch education and research of a broad spectrum from natural science to all branches of technology, including architecture, industrial economics, urban planning, work science and environmental technology. Apart from research performed at our departments, 10 competence centres are housed here at KTH and we contribute to another three national ones. Strategic research foundations are also funding other research programmes or graduate schools. Studies at KTH can lead to a number of degrees : Architect, Master or Bachelor of Science, or Doctor/ licentiate in either science or philosophy. Continuing education is also an important part of our activities.

KTH was founded in 1827 and is the largest of six universities of technology. Since 1917 KTH has been housed in central Stockholm in beautiful buildings which today have historical monument status, and associat-





ed colleges etc. are also found in various places outside Stockholm. At Electrum in Kista, the main Swedish resource centre of information technology, KTH co-operates with Stockholm University, other research centres, and with industry. Extensive co-education schemes are carried out with a number of regional university colleges, where many of the MSc engineering students may complete their first two years before going to KTH in Stockholm.

KTH is organised in five schools, KTH School of Industrial Management (KSIM) and a college of applied engineering. There are a number of departments within the schools, each possesses a wide and comprehensive scientific competence for research and undergraduate education: School of Architecture, Surveying and Civil Engineering, School of Electrical Engineering and Information Technology, School of Chemistry and Chemical Engineering, School of Mechanical and Materials Engineering, School of Engineering Physics, College of Engineering.

-Uppsala University

Uppsala University was founded in 1477 and is the oldest university in the Nordic countries. With its eight faculties of Theology, Law, Medicine, Pharmacy, History and Philosophy, Language, Social Sciences, and Science and Technology, and its Division of Education and Teaching Professions, Uppsala University offers a broad spectrum of educational and research opportunities.



2. Finland

2.1 The Finnish Higher Education System

The Finnish education system consists of comprehensive school, post-comprehensive general and vocational education, higher education and adult education. The Government goal is to streamline the system and develop it in accordance with the principle of lifelong learning and to make it internationally compatible. The level of education in Finland has risen significantly since the 1960s, and the younger generation is now especially well-educated.

Higher vocational education leads to post-secondary and higher vocational qualifications, which take from 2 to 4.5 years to attain. Students who have passed the matriculation examination or have a basic vocational qualification are eligible for admission. The system is currently being reformed: eventually, all higher vocational education will be provided at polytechnics. Education under the old post-secondary system started for the last time in 1998. Experiments with the polytechnic system began in 1991, when the Government granted permission to set up 22 experimental institutions. The purpose of the experiment is to raise the standard of higher





vocational studies and to rationalize the structure of the education system. The three and a half or four-year polytechnic degree programmes have been developed from post-secondary and higher vocational programmes. There are altogether 32 polytechnics (autumn 1998), 20 of which are permanent and 12 still temporary. Most of these institutions are multisector establishments. A permanent network of polytechnics will be in place by the end of this decade.

There are 20 universities in Finland, ten of which are multifaculty institutions and ten specialist institutions. Of the specialist institutions three are universities of technology, three are schools of economics and business administration, and the remaining four are art academies. In addition, university-level education is provided at one military academy under the Ministry of Defence. All universities engage in both education and research and have the right to award doctorates. The first university degree, which roughly corresponds to a Bachelor's, can generally be attained in three years of full-time study and the higher, Master's degree in five years, i.e. additional two years after the Bachelor's degree. There is also an optional pre-doctoral postgraduate degree of licentiate, which can be completed in two years of full-time study after the Master's degree. Full-time studies for a doctorate take approximately four years following the Master's degree.





The development of Finnish researcher training has been one of the main priorities in science policy over the past decade. In addition to the graduate school system created in 1995, programmes have been implemented to develop postdoctoral research and to promote women's research careers. Today there are 100 graduate schools and the total number of doctoral students in these graduate schools is nearly 4000. Most graduate schools are networks of several universities. The annual number of new Ph.Ds is presently ca. 1000; twice as many as in 1990.

2.2 Polytechnics

The Finnish higher education system consists of two sectors: universities and polytechnics. The polytechnics are more practically oriented, training professionals for expert and development posts. There are 29 polytechnics in Finland; most of them are multidisciplinary, regional institutions, which give particular weight to contacts with business and industry. Polytechnics are developed as part of the national and international higher education community, with special emphasis on their expertise in working life and its development. The polytechnics also carry out R&D relevant to their teaching and to the world of work.

The polytechnics were created gradually over the 1990s. The standard of former higher vocational education was raised and incorporated into multidisciplinary polytechnics. Since the Polytechnics Act was passed in 1995, the Government has accredited some polytechnics annually to operate on a permanent basis. The criteria used in accreditation include proven excellence in experimental and development work. The national polytechnics network will be complete by 1 August 2000, when all the polytechnics will operate on a permanent basis.

The polytechnics award professionally oriented higher education degrees, which take 3.5 or 4 years. The entry requirements is either an upper secondary school certificate or a vocational diploma. At present about 70 % of all entrants are matriculated students and 30 % vocational graduates. The Ministry of Education confirms the degree programmes. There is no tuition fee for degree studies.

The polytechnics have two categories of teachers: principal lecturers, for whom the requirement is a post-graduate (licentiate or doctorate) degree, and lecturers, who must have a Master's degree. Both categories of teachers must have a minimum of three years of work experience.

2.3 University Education

The university has the longest tradition in Finnish education. The first seat of higher learning, the Royal Academy of Turku, was established in 1640 during the era of greatness of Sweden-Finland. In 1828 the university was transferred to Helsinki and renamed the Imperial Alexander University. It was the only university in



Finland up to the early 1900s, when the first specialised higher education establishments, the University of Technology and the School of Economics and Business Administration, were founded. The twenties saw the establishment of the University of Turku and the Swedish-language Abo Akademi University (Turku). The expansion was rapid from the sixties to the eighties. In the most recent reforms the Academy of Fine Arts was upgraded to the university level (1993) and the College of Veterinary Medicine was incorporated into the University of Helsinki (1995).

There are altogether 20 universities in Finland: ten multifaculty universities, three universities of technology, three schools of economics and business administration, and four art academies. Geographically, the network covers the whole country.

The number of university students grew by nearly 40 % over the past decade. At present there are 147,000 university students in Finland, of whom 19,000 are postgraduate students. The largest fields of study are technology, the humanities and the natural sciences, and the smallest are fine arts, theatre and dance, and veterinary science.

The degree system was overhauled in the 1990s with a view to international equivalence, larger freedom of choice, and comprehensive degrees allowing flexible combinations of study modules from different fields and establishments. In the new degree system, it is possible to study for a Bachelor's or Master's degree in 20 different fields of study. The Bachelor's degree (120 credits) can be taken in three years and the Master's (160 credits) in five years. Graduates can go on to study for a postgraduate degree, the licentiate and the doctorate. The annual number of degrees in Finland is 16,000, of which 11,000 are Master's degrees and 1,000 doctorates. The average duration of studies is 6.5 years

2.4 Some Finish Universities of Engineering

- University of Oulu
- Abo Akademi University
- Helsinki University of Technology
- Lappeenranta University of Technology
- Tampere University of Technology

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