Project THEIERE

Thematic Harmonisation in Electrical and Information EngineeRing in Europe

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Towards the harmonisation of Electrical and Information Engineering Education in Europe

Towards the harmonisation of Electrical and Information Engineering Education in Europe" is a monograph elaborated during the academic years 2002 and 2003. This document proposes a "state of the art" relative to the curricula available in Europe in "Electrical and Information Engineering" (EIE), together with a statement of the reflections about the implementation in our disciplines of the Bologna process (i.e. the transition to the Bachelor-Master-Doctorate degrees).

Chapter about ESTONIA

12. EE: Eesti (Estonia)

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12.1. General information

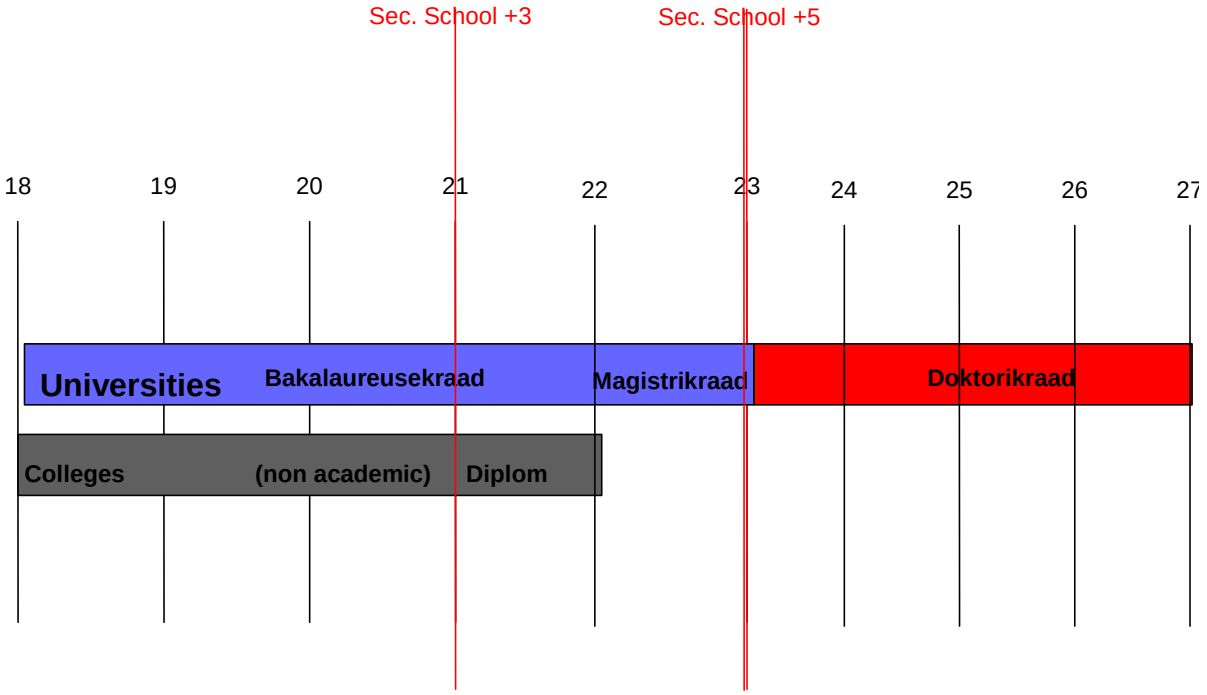


Figure 12.1: Estonian Higher Education System in EIE disciplines

In Estonia, there are 52 universities for 1.5 millions inhabitants. 1/3 students pay their studies by themselves.

- The Estonian higher education system is binary:
  - universities (ülikool)
  - applied higher education institutions (rakenduskõrgkool) - colleges
- The system also incorporates some vocational higher education (kutsekõrgharidus) programmes at post-secondary vocational institutions (kutseõppeasutus)
- The higher education institutions can be state, public or private institutions
- The right to award diploma or degree lies with the state college and the public university recognised by the state
- Diplomas awarded by the private higher education institutions are recognised after the accreditation

Organisation of a course of study

- Academic year is divided into two semesters: the autumn and spring semester
- Academic year begins in September and ends in the first half of June. In general, it contains 40 weeks of lectures, seminars, practical training and two examination periods.
- The capacity of studies is measured in credits. One credit corresponds to forty hours (one study week) of studies performed by a student in whatever way. The nominal academic year consists of 40 credits (60 ECTS credits)

12.1.1 Electrical and Information Engineering in Estonia, borders of the academic field

In Estonia, the EIE specialities are specialities of very high priority. The largest educational institution in this area is Tallinn Technical University, where most EIE specialists are thought. The graduates of TTU have given a lot of help in bringing the economy of Estonia to high technology level and many of them occupy high places in Estonian banking and economy, in industrial, energetic and ICT companies. The list of specialities in Tallinn Technical University is quite wide: in the field of Information Technology: Informatics, Computer and Systems Engineering, Telecommunication, Electronics, Business Information Technology and Computer Science; in the field of Electrical Engineering: Electrical Drives and Power Electronics and Electrical Power Engineering. Altogether, TTU excepts about 650-700 students on EIE specialities every year, about 400 of them to government paid study places. Some EIE specialities are also thought in Tartu University and in Tallinn Pedagogical University. The applied higher education in EIE field can be obtained in several colleges, most of which are connected to some university. Estonian Information Technology College (EITC, founded in 2000) is the largest educational institution of that kind in the IT field. EITC prepares the specialists of “IT Systems Development" and "IT Systems Administration" specialities. The most part of study plans of EITC is developed by professors of TTU, and the study process is conducted in close co-operation with IT faculty of TTU.

12.1.2 Pedagogical content of the curricula

General requirements for studying and teaching are set by the Standard of Higher Education (SHE, adopted by the Government 13.08.2002). The SHE is a set of regulations instituted by the Government of the Republic. It specifies the purpose of a given program of instruction leading to a certification of trade, vocational, or professional competence; the list of trades and occupations to which its regulations

apply; and the general requirements that curricula must meet, also the list of study fields and specialities.

The content of the curricula of all specialities is approved by curricula committee of the faculty consisting of professors and industry experts and by Council of University (TTU, TU, etc.). The curricula pass regular obligatory accreditation, during which independent international experts evaluate the curricula. Based on the reports of the expert committees the Higher Education Quality Assessment Council decides on accreditation of the curriculum. The accreditation is valid for 7 years, in case of conditional accreditation the accreditation procedure has to be repeated in 2 years. The admission to the unaccredited curricula will be terminated.
The educational contents of the degrees given in Estonia are presented in the following.

Non-academic higher education qualifications

- Vocational higher education diploma (kutsekõrghariduse diplom)
  - One-stage higher education offered by secondary education based vocational education institution (kutseõppeasutus) or college.
  - The length of study is from three to four years, the total capacity of studies 120 – 160 credits.
  - Vocational higher education programme includes practical training, accounting for at least 35% of the total capacity.
  - The graduates who have completed their studies are awarded a diploma with indication of their speciality.
- Diploma (Diplom)
  - One-stage non-academic applied higher education. The length of study is from three to four years, 120 – 160 credits.
  - Diplom-study is a specialised higher education study, consisting of studying and acquisition of practical knowledge and skills.
  - Acquisition of practical skills, including training, must have a total capacity of not less than 10 credits.
  - The graduates who have completed their studies will be awarded a diplom (with no academic degree).
  - Diplom-study can be performed at universities (up to 2002) and colleges.
  - The study programme of diplom-study at university and that of bakalaureus-study may have a common part.

Academic higher education qualifications

- Bakalaureusekraad (Bachelor)
  - First stage of academic study, the main purpose of which is to increase students' level of general education and develop theoretical knowledge and professional skills for the selected area of employment and further study.
  - Bakalaureus-level study is conducted in universities, and the length of study is 3 – 4 years (up to 1999 – 4 years, since 2002 – 3 years).
  - Bakalaureus-study is a theory-based wide-range study.
  - Research, professional or creative work, including final thesis, shall have a capacity of not less than 20 credits.
  - The graduates who have completed their studies will receive a diploma, certifying the obtained bakalaureusekraad.
- Magistrikraad (Master)
  - Second stage of academic study, the main purpose of which is to deepen theoretical and specialist knowledge and develop proficiency in research, professional or other creative work for individual use of knowledge and skills.
  - Admission requirement is the bakalaureusekraad or an equivalent level of academic education.
  - The length of study is 1 – 2 years (up to 1999 and since 2002 – 2 years).
  - The study will be completed with the defence of a thesis.
  - The degrees are divided into research and professional degrees. The graduates who have completed their studies will receive a diploma, certifying the obtained magistrikraad.
- Doktorikraad (PhD)

- Third stage of academic study, consisting of comprehensive research, professional or other creative work and related studies.
- Admission requirement for doktor-study is the magistrikraad or an equivalent level of academic education.
- The nominal length of study is four years.
- The degrees are divided into research and professional degrees.
- The graduates who have completed their studies will receive a diploma, certifying the acquired doktorikraad.

- University diploma
  - University diploma with the qualification of engineer, is the part of old system of university qualifications, which is issued to the graduates, who started their study before 1 January 1995.
  - One-stage academic higher education.
  - The length of study is four or five years, the total capacity of studies is 135 or 180 credits.
  - The graduates who have completed their studies will receive a diploma, certifying the obtained title of engineer.

12.1.3 Implementation of the 3-5-8 system in Estonia

Up to year 2001 the 4-6-10 study system was used in Estonian high education. The Government of Estonia has fixed the goal to be achieved for higher educational institutions to take into account the tasks related to the consequences of the accession of Estonia to the European Union. All substantial features of the Bologna mainframes were built into the SHE.

According to SHE the renovation of curricula was conducted and in year 2002 new 3-5-9 curricula were introduced. Doctoral programs were also substantially renewed and brought up to date, but they still remain mostly 4-year programs. The number of different programs was brought down to minimum. For example, in TTU there are only two doctoral programs in area of EIE: “Information and Communication Technology” and “Power Engineering and Geotechnology”. From year 2002 the applied higher education and diploma studies take place only in colleges.

12.1.4 References

The information given in this monography are based on the following documents:

http://www.hm.ee/	(Estonian Ministry of Education)
http://www.ekak.archimedes.ee/	(Higher Education Quality Assessment Council)
http://www.ttu.ee/index_eng.html	(Tallinn Technical University)
http://www.ut.ee/english/	(Tartu University)
http://www.itcollege.ee/inenglish/index.php	(Estonian Information Technology College)
http://www.tpu.ee/english.html	(Tallinn Pedagogical University)

12.2. Figures on the weight of EIE in Estonia

Figure 12.2: EIE students in Estonia in the first semester 2001/02

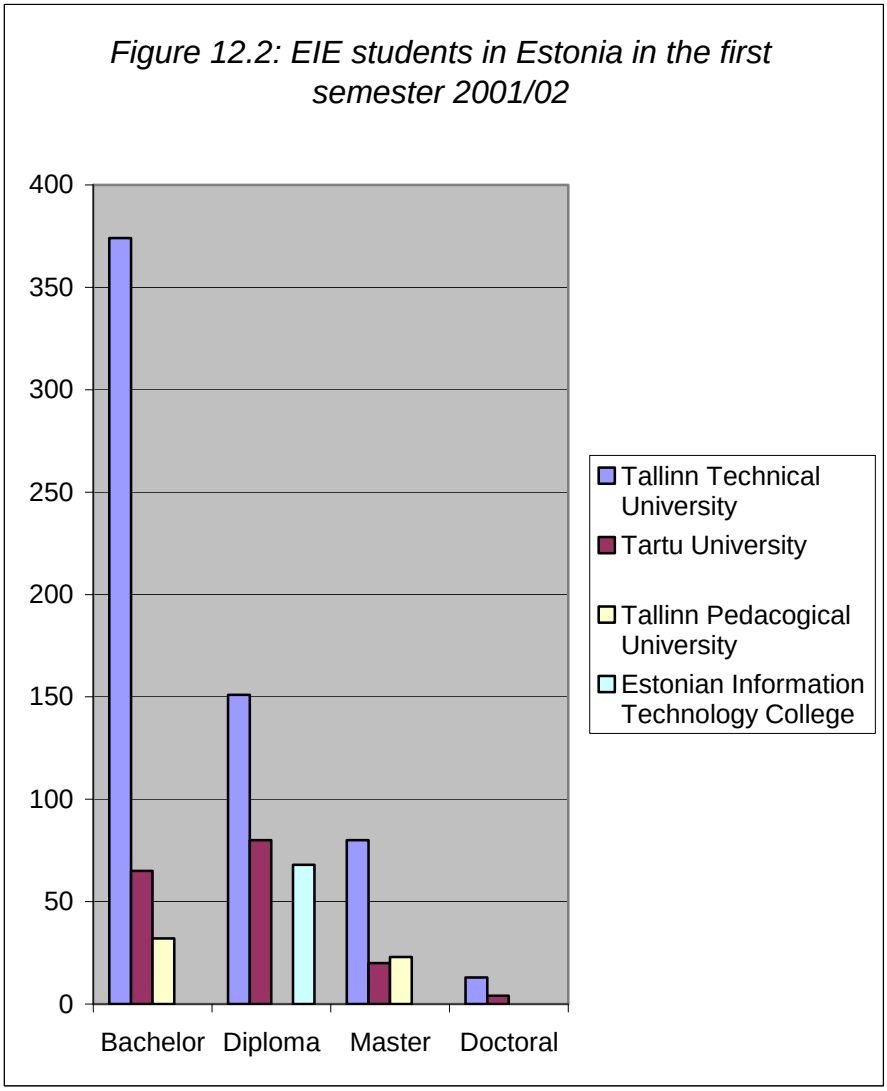


Figure 12.3: Students in Tallinn Technical University in 2001/2002

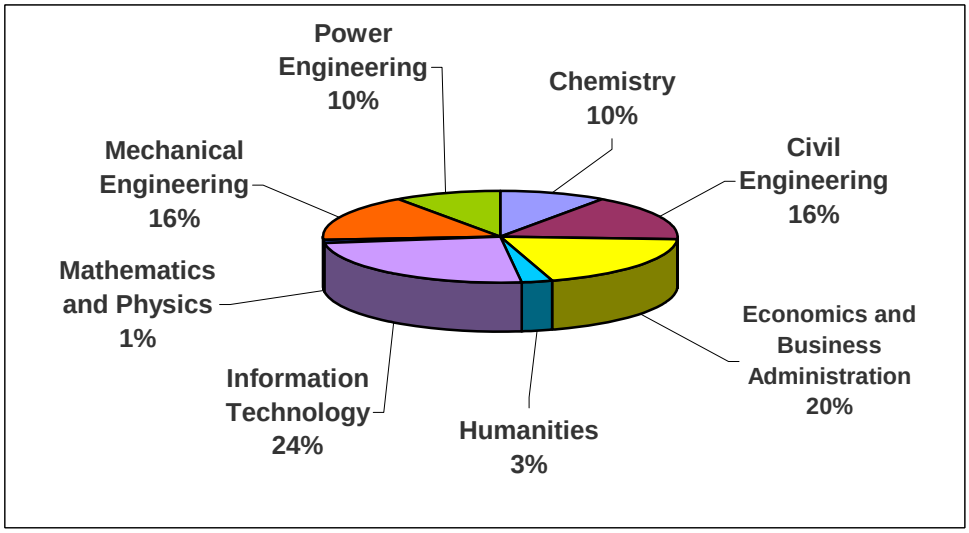


Figure 12.4: Students in the first semester in the IT faculty of Tallinn Technical University 2002

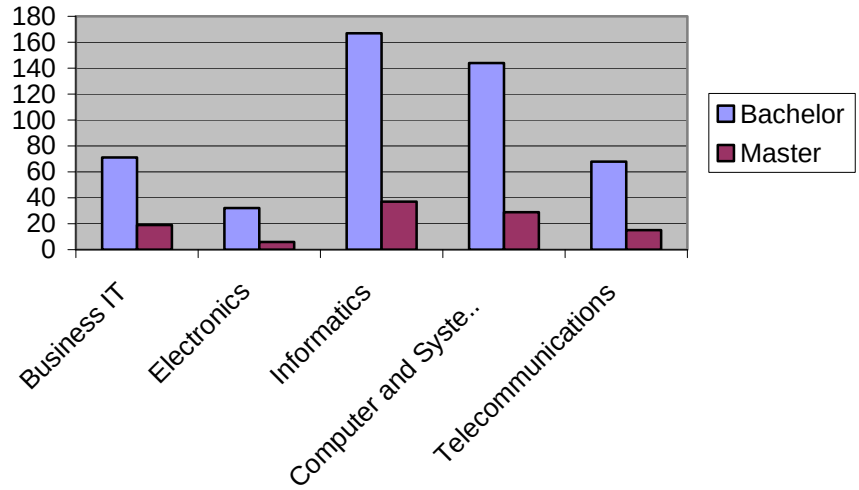
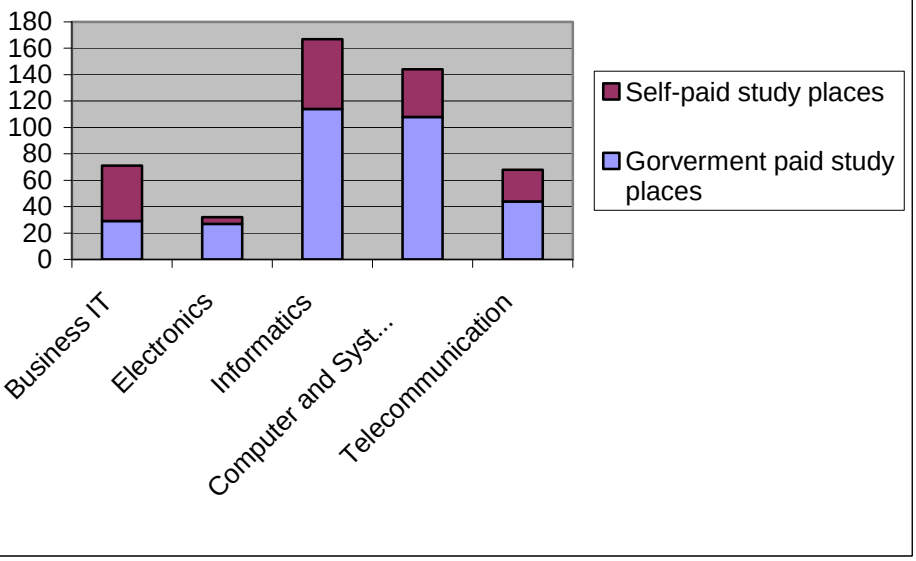


Figure 12.5: Bachelor students in the first semester (IT faculty of Tallinn Technical University, 2002)



12.3. Degrees in EIE in Estonia

Non-academic higher education qualifications

- Vocational higher education diploma
- Diploma

Academic higher education qualifications

- Bakalaureusekraad (Bachelor)
- Magistrikraad (Master)
- Doktorikraad (PhD)
- University diploma

12.3.1 Before bachelor (Vocational higher education ~~technician level~~, ~~??????????~~)

IT Systems Administration

Specialities: Computers & Networks –10%, Programming – 15%, IT Systems: Analysis, Design& Programming – 17.5 %, IT Systems Administration - 10 %, Diploma Thesis – 8%
Openness: Mathematics&Physics - 9%, Humanities &Economics – 11% , English – 4.5%, Industrial Training – 15%

IT Systems Development

Specialities: Computers& Networks –13%, Programming – 15%, IT Systems: Analysis & Design – 10.5 %, IT Systems Development - 10 %, Diploma Thesis – 8%
Openness: Mathematics&Physics – 13%, Humanities &Economics – 11% , English – 4.5%, Industrial Training – 15%

Information Technology

Specialities: Computers –12%, Programming -12%, Special Software – 20%, Hardware - 8%, Diploma Thesis – 5%
Openness: Mathematics&Physics - 8%, Humanities &Economics – 15% , English – 5%, Industrial Training – 15%

Telecommunication Equipment

Specialities: Computers & Networks - 8%, Electronics & Telecommunication Basics –14%, Programming -5%, Telecommunication Hardware & Software – 21%, Diploma Thesis – 5%
Openness: Mathematics&Physics - 10%, Humanities &Economics – 13% , English – 5%, Industrial Training – 15%

12.3.2 Bachelor level

Bachelor in Electronics :

Specialities: Electronics – 21% , Informatics – 12,5% , Telecommunications – 10% , Networks – 7,5%, Control – 9%
Openness: English – 2%, Expression-communication – 2%, Humanities – 8%, Industrial training – 2,5%

Bachelor in Telecommunications :

Specialities: Electronics – 5% , Informatics – 16% , Telecommunications – 27% , Networks – 10%, Control – 6%
Openness: English – 2%, Expression-communication – 2%, Humanities – 8%, Industrial training – 2,5%

Bachelor in Computer and System Engineering :

Specialities: Electronics – 5% , Informatics – 33% , Telecommunications – 3% , Networks – 8%, Control – 12%
Openness: English – 2%, Expression-communication – 2%, Humanities – 8%, Industrial training – 2,5%

Bachelor in Informatics

Specialities: Introduction to Informatics - 10 %, Signals, Circuits& Systems – 8 %, Computers & Networks - 9 %, Programming – 20.5 %, Information Systems or Network Applications – 12 %, Bachelor Thesis - 4 %.
Openness: Mathematics& Physics - 22.5 %, Humanities& Economics – 9.5 %, English - 2 %, Industrial Training – 2.5 %.

Bachelor in Business Information Tehnology

Specialities: Introduction to Informaion Technology - 7 %, Computer& Network – 6 %, Information Systems – Analysis, Design, Programming and Development – 37.5 %, Network Applications – 6 %, Organization Management – 7.5 %, Bachelor Thesis - 4 %.
Openness: Mathematics& Physics - 16 %, Humanities& Economics – 11.5 %, English - 2 %, Industrial Training – 2.5 %.

Bachelor in Electrical Drives and Power Electronics

Specialities: Informatics – 4%, Measurements – 4%, Microprocessors& Electronics – 10 %, Robots – 6%, Control – 9 %, Electrical Engineering – 21.5 %, Electrical Drives – 18 %
Openness: Mathematics& Physics – 17%, Humanities& Economics – 6%, English – 2%, Industrial Training – 2.5 %.

12.3.3 Intermediary level, between bachelor and master

Informatics

Specialities: Introduction to Informatics - 8 %, Computers & Networks – 4.5 %, Programming – 14 %, Information Systems – Analysis, Design, Programming and Development - 38 %, Information Systems and Network Management – 3 %, Diploma Thesis - 6 %.
Openness: Mathematics - 9 %, Humanities& Economics – 11.5 %, Industrial Training – 6 %.

Computer Systems

Specialities: Computers & Networks –12 %, Programming –23.5 %, Microprocessor Systems – 6 %; Digital Systems- Diagnostics, Design and Test – 12 %; Hard- and Software Codesign – 5%; Systems-on-Chip Design – 5%; Diploma Thesis - 6 %.
Openness: Mathematics& Physics - 13 %, Humanities& Economics – 11.5 %, Industrial Training – 6 %.

Telecommunication

Specialities: Signals, Circuits, Systems, Control - 6 %; Informatics- 5 %; Electronics – 7 %; Signal Processing, Signal Processors – 12 %; Microwave Engineering - 7 %; Telecommunication Networks and Systems – 26.5 %, Diploma Thesis - 6 %.
Openness: Mathematics& Physics - 13 %, Humanities& Economics – 11.5 %, Industrial Training – 6 %.

Network Software

Specialities: Introduction to Computer Science - 18 %, Computers & Networks – 6 %, Programming – 14 %, Information Systems – 13 %, Network Applications - 12 %, Diploma Thesis - 6 %.
Openness: Mathematics& Physics - 14 %, Humanities& Economics – 11 %, Industrial Training – 6 %.

Admittance to these specialities finished in 2001.

12.3.4 Master level

Master in Electronics :

Specialities: Electronics – 14 %; Data Acquisition and Measurements, Sensor Signal Processing – 9 %; Circuit Design, ASIC design, Chip Design, Test and Diagnostics – 15.5 %; Electronic Systems - 15 %; Biomedical Electronics - 9 %; Master Thesis - 25 %.
Openness: Humanities& Economics – 6%; English – 2.5 %, Industrial Training – 4 %

Master in Telecommunications :

Specialities: Communication Theory – 7.5; Signal Processing & Signal Processors – 16.5 %; Telecommunication Networks and Systems – 14 %; Telecommication Systems Analysis, Modelling and Design – 18.5 ; Telecommunication Standards – 6%; Master Thesis – 25%.
Openness: Humanities & Economics – 6 %, English – 2.5 %, Industrial Training – 4 %.

Master in Computer and Systems Engineering

Specialities: Digital Systems – Modelling, Diagnostics, Test, Design and Programming – until 30 %; Signals, Systems and ASIC Design – until 16 %; Modelling and Control – until 17.5 %; Control Instrumentation – until 24% ; Embedded Systems –until 10%; Software Engineering – until 30%; Project Management – until 10%; Master Thesis – 25%.
Openness: Humanities & Economics – 6 %, English – 2.5 %, Industrial Training – 4 %.

Master in informatics

Specialities: Advanced Programming - 11 %, Data Security – 9 % , Information Systems – Analysis, Design, Programming and Development -21%; Network Applications – 12.5 %, Network Administration - 9 %, Master Thesis - 25 %

Openness: Humanities& Economics – 6 %, English – 2.5 %, Industrial Training – 4 %.

Master in Informatics (for them whose Bachelor degree was not Informatics)

Specialities: Programming – 12 %, Data Security – 5 % , Information Systems –Analysis, Design, Programming and Development –33.5 %; Network Applications – 12 %, Project Management - 6 %, Master Thesis - 25 %.

Openness: English – 2.5 %, Industrial Training – 4 %.

Master in Business Information Tehnology

Specialities: Data Security – 9, Information Systems – Analysis, Design, Programming and Development – 23 %, Network Applications – 6 %, Intelligent and Agent Systems – 11.5% , IT Projects Management - 19 %, Master Thesis - 25 %.

Openness: English – 2.5 %, Industrial Training – 4 %.

Master in Electrical Drives and Power Electronics

Specialities: Electrical Engineering – 6 %, Programming – 6 %, Automation – 9%, CAD – 9 %, Electricac Drives – 11%, Robots –6%, Power Electronics –6%, Master Thesis – 25%.

Openness: Mathematics – 4.5 %, Humanities& Economics – 15%, English – 2.5%.

12.3.5 Doctoral level

Doctor in Information and Communication Technology

List of specialities: Informatics, Information Technology, Computer and Systems Engineering, Electronics, Telecommunication**.**

Specialities - 19%, **Openness** - 6%, **Doctoral Thesis** - 75%

Doctor in Power Engineering and Geotechnology

Specialities - 21%, **Openness** - 4%, **Doctoral Thesis** - 75%

12.4. List of Institutions in the field of EIE

Universities:

- **Tallinn Technical University (TTU, Tallinna Tehnikaülikool)**
  - Faculty of Information Technology (Infotehnoloogia teaduskond)
  - Faculty of Power Engineering (Energeetikateaduskond)
  - Virumaa College of TTU (TTÜ Virumaa Kolledž)
- **Tartu University (TU, Tartu Ülikool)**
  - Faculty of mathematics and informatics (Matemaatika-informaatikateaduskond)
  - Faculty of Physics and Chemistry (Füüsika-keemiateaduskond)
- **Tallinn Pedagogical University (TPU, Tallinna Pedagoogikaülikool)**
  - Faculty of Mathematics and Natural Sciences (Matemaatika-loodusteaduskond)
  - Haapsalu College of TPU (TPU Haapsalu Kolledz)

State Colleges:

- **Estonian Information Technology College (EITC, Eesti Infotehnoloogia Kolledž)**
- **Tallinn Polytechnic School (Tallinna Polütehnikum)**

12.4.1 Before bachelor (~~technician level,~~ vocational higher education ~~??????????~~)

- **Estonian Information Technology College**
  - IT Systems Administration
  - IT Systems Development
- **Tallinn Polytechnic School**
  - Information Technology
  - Telecommunication Equipment

12.4.2 Bachelor level

- **Tallinn Technical University**
  - **Faculty of Information Technology**

Electronics
Telecommunication
Computer and Systems Engineering
Informatics
Business Information Technology

  - **Faculty of Power Engineering**

Electrical Drives and Power Electronics

  - **Virumaa College of TTU**

Informatics

- **Tartu University**
  - **Faculty of mathematics and informatics**

Informatics
Information Technology

  - **Faculty of Physics and Chemistry**

Information Technology

- **Tallinn Pedagogical University**
  - **Haapsalu College of TPU**

Informatics

12.4.3 Intermediary level, between bachelor and master (University diploma, ~~Fachhochschule, …. ???~~)

- **Tallinn Technical University**
  - **Faculty of Information Technology**

Telecommunication

Computer Systems
Informatics
Network Software

12.4.4 Master level

- **Tallinn Technical University**
  - **Faculty of Information Technology**

Electronics
Telecommunication
Computer and Systems Engineering
Informatics
Business Information Technology
Informatics for non-informatics

  - **Faculty of Power Engineering**

Electrical Drives and Power Electronics

- **Tartu University**
  - **Faculty of mathematics and informatics**

Informatics
Information Technology

  - **Faculty of Physics and Chemistry**

Information Technology

- **Tallinn Pedagogical University**
  - **Faculty of Mathematics and Natural Sciences**

Informatics
IT management

12.4.5 Doctoral level

- **Tallinn Technical University**
  - **Faculty of Information Technology**

Information and communication Technology

  - **Faculty of Power Engineering**

Power Engineering and Geotechnology