Budapest University of Technology and Economics
Doctoral School of Electrical Engineering
Training plan
2019

Antecedents

According to the Higher Education Act (Act CCIV of 2011 on National Higher Education amendment based on Bill T / 4767, 2015 CXXXI. Act) doctoral training has changed as of September 2016.

The main points of the change are the following:

• Doctoral training changes from 6 semesters to 8 semesters.

• The number of credits to be obtained for the dissertation increases to 240 credits.

• Two-stage training:

(i) the first is the "training and research phase", which lasts for 4 semesters, is mainly based on contact hours

(ii) the second is the “research and dissertation phase”, also 4 semesters, at the end of which the actual acquisition of a doctoral degree takes place (during this period the student can devote his/her time on the field of research and continue the scientific activity on which the dissertation is based on.

• At the end of the 4th semester students need to take a complex review exam – CRE - (by the result of which the state-funded scholarship may be revoked or the training may be interrupted). The complex exam replaces the comprehensive examination, but it also includes the evaluation of research results as a new element.

• After the 4th semester and the CRE, the dissertation must be submitted within 3 years (this deadline can be extended by an additional 1 year in extraordinary cases).

• The student can only have the student status for 8 semesters (2 passive semesters are possible).

• Individual preparers for the degree can also join the doctoral training, provided that he/she has met the requirements for admission and doctoral training. The student legal relationship is only established by the application and acceptance for the complex exam.

Professional competences

PhD degree in Electrical Engineering

a) knowledge

A prospective PhD doctorate in Electrical Engineering interprets and handles specific mathematical, natural and social scientific principles, rules, relations and procedures in a creative way. He/she interprets the anticipatory trends of the development and improvement of technical science innovatively as well as the related requirements and progress trends in other professional areas (logistics, management, environment, quality assurance, information technology, law, economics, work- and fire safety, security technology). He/she has the necessary methodological knowledge for doing scientific research in electrical engineering. He/she is familiar with contemporary methods in higher education.

b) skills

In order to widen and improve common professional knowledge, he/she applies mathematical and natural scientific principles, rules, relations and procedures innovatively. He/she is able to do scientific research within the area of electrical engineering, to solve special problems, to create and apply new interdisciplinary methods as well as to organize and govern interdisciplinary research groups. He/she is able to develop and disseminate new research techniques and approaches. He/she is able to apply ICT tools and methods in the research work creatively and to contribute to higher educational activities in his/her research area.

c) attitude

He/she is committed and critical to the technological development and innovation in the technical professional area. He/she is proactive yet critical in developing new methods and tools in the technical professional area. He/she is also committed to fulfill quality requirements.

d) autonomy and responsibility

He/she solves engineering problems in a creative way, plays leading role in solving technical problems, takes part in professional cooperation as a leader, and creatively initiates new research directions. He/she participates in professional discussions and exchange of views on a par with his/her peers from other related technical areas. He/she takes responsibility for the entire system of professional activity led by himself/herself.

The elements of PhD studies

The core element of PhD doctoral studies is the scientific research work related to the topics announced by the doctoral school. Every PhD student has an assigned PhD supervisor who coordinates the studies, the research work, the publication of the results and the preparation of the dissertation. Only in case of interdisciplinary scientific work or research topics carried out with international cooperation is dual supervision of PhD students allowed by the preliminary permission of the Council of the Doctoral School and the Doctoral Committee of the University. In case of external supervision with the agreement of the Doctoral School, the Council of the Doctoral School assigns an internal (university) advisor for the PhD student who helps the work of the external supervisor and controls the studies.

During doctoral studies PhD students can choose regular doctoral courses announced by the Doctoral School as well as other MSc or PhD courses (even other university courses) which are admitted and accredited by the Doctoral School. The set of possible courses also includes a presentation series of invited speakers from abroad as well as Eötvös Loránd University (ELTE) doctoral courses based on a special mutual agreement with ELTE. The achievable credits for doctoral courses are allocated in the first 4 semesters of the program. In the second 4 semesters, course credits can also be obtained for verified and successful participation in intensive international courses and summer schools.

One part of the training is ***guided teaching*** during which the PhD student improves his/her performing and communication skills tutored by an assigned teacher. The subject and its adherent credits are determined by the head of the department after having agreed with the supervisor. The completion of a subject is also verified by the head of department based on the proposal of the supervisor. Teaching activities exceeding the amount prescribed in doctoral training must be paid in the manner described in Section 179 of the BME TVSZ.

Regular consultation of PhD students with their PhD supervisors is also an important element of doctoral studies. This process aims to support research work and publication activity of PhD students and is also acknowledged by credits.

The PhD supervisor assesses the preparedness and the consultation activity of PhD students by grades every semester.

In the second part of the PhD studies the emphasis is on the scientific research work, the publication of the results and the completion of the dissertation. The publication of the new results in journals or conferences, the scientific study tour, the research work at foreign scientific partners are acknowledged by research credits.

Provided that publication prerequisites for the complex exam is fulfilled by the end of the 4th semester, and the publication minimum requirements for the PhD degree are accomplished by the end of the 8th semester, publication credits are approved.

PhD students need to make a presentation on their achieved results on the PhD Professional Day in order to obtain research credits.

PHD Recommended study plan

Subjects	**Contact hours / credits**	**Semester 1**	**Semester 2**	**Semester 3**	**Semester 4**	**Semester 5**	**Semester 6**	**Semester 7**	**Semester 8**
Elective 1	4/5	4/5							
Elective 2	4/5	4/5							
Elective 3	4/5		4/5						
Elective 4	4/5		4/5						
Elective 5	4/5			4/5					
Elective 6	4/5			4/5					
Teaching activity	24/30	4/5	4/5	4/5	4/5	4/5	4/5		
Research work	96/120	8/10	8/10	8/10	12/15	12/15	16/20	16/20	16/20
Publications	48/60	4/5	4/5	4/5	8/10	8/10	4/5	8/10	8/10

Altogether:	***192/240***	***24/30***	***24/30***	***24/30***	***24/30***	***24/30***	***24/30***	***24/30***	***24/30***

The aspects related to obtaining credit are the following:

Educational material

It is recommended that credits earned for studying subjects should be assigned for the first 4 semesters. The last 4 semesters should be about research and intensive publishing.

Scientific points

In the new system, more emphasis is placed on the tutorial nature of the training. Due to the 'supervisor consultation' within research activity, credit points are recognized (the evaluation for preparation and activity). The crucial part of research credits is recognized for research work, but may include conference / workshop participation, study visits, visit to institutes, etc.

Publishing activity

The goal is to automatically fulfill the minimum requirement of the Doctoral School of Electrical Engineering by obtaining publication credits

It has to be done in two steps:

- ✓ at the end of the 4th semester, the total number of credits for publication activity can only be obtained (25 credits) if the doctoral student has at least half of the minimum requirements of the publications required for obtaining the degree.
- ✓ at the end of the 8th semester, the total number of credits for publication activity can only be obtained (60 credits) if the doctoral student fulfilled all minimum requirements of the publications required for obtaining the degree.

Credit points for publication activity cannot be divided. In terms of publications, it is recommended to proceed according to the following criteria in order to make continuous progress:

• Publication credits for the 1st semester are awarded if the student already has an appeared publication or has at least one foreign language conference or journal article with a draft by the end of the semester.

• Publication credits for the 2nd semester are awarded if the student already has an appeared publication, or have at least one submitted conference or journal article in a foreign language by the end of the semester.

• Publication credits for the 3rd semester are awarded if the student already has at least one appeared conference or journal publication in a foreign language.

• Publication credits for the 4th semester are awarded if the student already has at least one appeared conference or journal publication in a foreign language and there is at least one journal article submitted to WoS or Scopus. At the same time, the candidate has obtained at least half of the minimum publication scores required for the degree.

• Publication credits for the 5th semester are awarded if the student already has at least one appeared conference or journal publication in a foreign language and there is at least one submitted journal article to WoS or Scopus and has an additional draft of a conference or journal article.

• Publication credits for the 6th semester are awarded if the student already has at least one conference publication in a foreign language and a Wos or Scopus journal publication and has at least one additional submitted peer-reviewed journal article in a foreign language or one additional submitted conference paper.

• Publication credits for the 7th semester are awarded if the student already has at least one appeared conference publication in a foreign language and a Wos or Scopus journal publication and has at least one additional submitted reviewed journal article in a foreign language.

• Publication credits for the 8th semester are awarded if the student already has at least the minimum points required to start the doctoral procedure.

Note: In order to get the publication credits, publications or drafts shall be demonstrated by uploading the data onto the website during the half-yearly revision.

The doctoral student's student status is terminated if he / she does not obtain at least 15 credits in an active semester (BME TVSZ § 186 2). A state-funded scholarship holder student who does not earn at least 20 credits in the active semester may be enlisted into fee-paying training by the decision of the dean on the proposal of the DIT (BME DHSZ 13 § 8).

Upon request, students participating in fee-paying training, may be enlisted to state-funded scholarship status (details: BME DHSZ § 13 8) based on the supportive opinion of DIT.

If a student submits his/her doctoral dissertation at any time during the second stage of the training and it is approved to be review phased by the Habilitation Committee and Doctoral Council (HBDT), the

research and publication credits of the semester will be recognized on the day of HBDT decision. A student who fulfills all curriculum and exam requirements as well as obtains all 240 credits, shall receive the leaving certificate while still having the student legal status until the last day of the semester (Section 59 (1) d) of the Nftv. point).

COMPLEX REVIEW EXAM

1. General information

Admission to the complex exam is subject to a minimum of 120 credits in the first four semesters of doctoral training and all required "training credits" in the curriculum of the doctoral school (except for individual students preparing for the doctoral degree, whose legal relationship is established by application and acceptance for the complex examination).

The complex exam must be taken in public, in front of a committee. The examination board shall consist of three members at least, one third of the members of which are not employed in a legal relationship with the institution operating the doctoral school. The chairman of the examination board shall be a university professor or a professor with the title of Professor Emeritus or a teacher, researcher with the title of Doctor of Science. All members of the examination board shall have an academic degree. The supervisor is a non-voting member of the committee. The supervisor shall submit the evaluation of student performance electronically to the chairman of the committee at least one week before the exam.

The complex exam consists of two parts: in the first part it is the theoretical knowledge of the candidate that shall be assessed (“disciplinary part”), the other part gives an account of the candidate’s scientific progress number (“dissertation part”).

- In the theoretical part of the complex exam, the candidate takes an exam in two subjects. The subjects are listed in the doctoral school’s training plan which is available on the doctoral school’s website.

- In the dissertation part of the complex exam, the candidate gives a presentation in the form of a lecture on his/her knowledge, reports on research results, describes his/her research plan for the second phase of the doctoral training, as well as the preparation for the dissertation and the schedule for publishing the results. His presentation shall cover scientific relevance of his/her results and the innovation content and, where relevant, his/her research on technological motivations as well as the applicability of practical results. The candidate must submit a brief summary of its achievements, and the articles submitted or published in electronic form at least one week before the exam.

The members of the examination committee evaluate the theoretical and dissertation parts of the examination separately. A complex exam is successful if the majority of committee members consider both exam parts successful. In case of a failed theoretical part of the exam, the candidate may repeat the examination one more time during the examination period

The dissertation part of the exam cannot be repeated during the examination period.

A report containing a textual assessment shall be prepared for the complex exam. The exam result shall be announced on the day of the oral examination.

The result of the complex exam does not count towards the qualification of the doctoral degree but its successful completion is the condition to step in the second phase of training.

2. Faculty implementation - the structure of the complex review exam

2.1 Conditions for admission to the complex review examination (hereinafter Examination) (as set out in the curricula of doctoral schools) are as follows:

- The application for the examination is approved by the Doctoral Committee (DC) of the Doctoral School. A doctoral student is eligible for the exam if he/she has achieved at least 120 credits in the first four semesters of her/his studies, and has fulfilled the study requirements set in the Doctoral Program. Only those applying for the examination as independent candidates are exempted from these criteria. In such cases, student status will come to effect after the application is approved by the DC.
- The publication criteria for approving the application for the CRE are: at least one journal paper appeared or accepted or submitted in a journal listed in the Web of Science database, and one refereed conference publication (for oral or poster presentation) appeared or accepted or submitted.

Please note that for the final assessment of the CRE, the DC will thoroughly investigate the quality of the publications, as well as the candidate's contribution to the achieved results.

● Both parts of the complex exam ("disciplinary" and "thesis" exam) are to be taken by the at the same time before the same committee.

2.2. Subjects to be chosen during the complex exam

Given the nature of doctoral training being based on professional groups, possible examination topics are linked to so-called Professional Blocks (PB). PBs consist of a comprehensive professional field items (min. 3, max. 5 items). Each PB has a min. 36 and max. 60 examination topics and a list of references to help with preparation. Currently (Informatics + Electrical Engineering) 8 PBs have been established.

As PBs include the integration of several subjects, the applicant has to select only 12 subject areas out of (max.) 60 when applying for the exam. For example, the student who learned only one subject from the subjects contained in the PB, then he/she should select 12 related topics. For those who studied more subjects from the given PB, the he/she has more freedom in selecting 12 topics of his/her interest to prepare.

In order to check the overall nature of the candidate's knowledge, he/she has to select 12 topics from 2 different PBs (eg. who has all the professional subjects from PB called Electric power engineering/Electrotechnics, then he/she can select PB Mathematics.

as a second block from which he/she can prepare on the basis of the second 12 selected topics).

The 8 PBs and their subjects are listed below:

PB	**Comprising subjects (or subject-based themes)**
Electric power engineering, Electrotechnics	Control of Electrical Machines and Drives I.; Power Systems I.; High Voltage and High Current Engineering
Computer science	Mathematical Statistics; Analysis of Matrices; Probability Theory; Foundation of Computer Science; Advanced Data Structures and Techniques for Analysis of Algorithms
Communication technologies	Infocommunication Theory; Queuing Theory I., Queuing Theory II.; Telecommunication Software Engineering; Provable Security

Microelectronics and technology	Microelectronics and Microsystems; Application of Numerical Methods in Electronics Technology Process Modeling; Instrumental Analytics in Electronics Technology; Applied Photonics
Adaptive systems and optimization	Adaptive Methods in Telecommunications; Applied Optimisation and Game Theory; Signal Processing
Dynamics systems and control	Adaptive Systems; Modelling and Identification of Dynamic Systems; Modern Control Theory I.
Material science for electrical engineering	Physics and Diagnostics of Insulations**;** Physics of Semiconductor Materials and Devices; Physics of Electromagnetic Fields; Nanoscience

As the subjects that make up PBs include compulsory elective subjects, students, having adequate background knowledge, are able to prepare for the exam as the knowledge, covering the selected part of the exam topics, is already obtained by passing the subjects.

2.3. Content elements of the exam and the evaluation process:

The conditions for the content of the examination board are included in the training plan.

Elements and scoring of the subject exam

The candidate shall select a topic containing 12-12 elements from 2 Professional Blocks and take an examination before the examination board. Each member of the examination committee evaluates the answers given from the Professional Blocks separately from 1 to 5 (scoring 70% required).

Aspects and scoring of the "thesis exam"

● Based on the literature on the topic, describe the results of the field so far and the open questions where you carried out the research

● Describe the theses you have achieved so far during your research (or will achieve in the next 1 year) (at least two of these results)

● Summarize the content of your publications so far and tell us what publication you are planning in the future

● Describe the plans, tasks and tasks for the completion of the dissertation for the next two years.

Recommended scoring of the thesis exam:

● Doctoral studies (max. 30 points):

o (credit points obtained / 90) * (average of the obtained marks/ 5) * 30, or max. 30 points in case it exceeds 30 points (it is not only the marks, but also the credit points that count according to the recommended study plan).

● Publication performance (max. 40 points):

- In case of published publications: (points obtained according to doctoral scoring / 6) * 40, or max. 40 points if the score exceeds 40.
- In case 40 points is not reached from the previous score, but already has an accepted publication, then max.one submitted but not yet accepted publication is accepted with proof of submission:

▪ points received for all publications (published + submitted) according to the doctoral score) / 2 * 30, or max. 30 points if someone exceeds 30 points.

● Knowledge of the topic and outlining the theses based on the oral presentation (max. 30 points)

A complex exam is successful if all of the following conditions are met:

▪ The candidate received at least 15 points for doctoral studies

▪ For both subjects, the average of the points obtained for the exam reaches 3.5.

▪ Knowledge of the topic and outlining the theses based on the oral presentation, the candidate scored at least 20 points

▪ for the part of Publication Performance, the candidate achieved at least 15 points

▪ The total score of the thesis exam exceeds 50 points

2.4. How to apply for and take the exam

Before applying, it is definitely advisable to consult with the supervisor about the selected Professional Blocks and topics, as well as for the thesis exam background materials.

Applying for the complex review exam takes place in the second year after starting doctoral studies (for studies starting in September the deadline is 15 May and for studies starting in February the deadline is 6 December) by an application that must be submitted to the Doctoral Council and uploaded materials (see application materials list below). The form is available electronically on the faculty website.

The following information must be provided and attached to the application:

● uploading all published publications (if any) to MTMT,

● listing of full publications (which have been published, which have been submitted, declarations of acceptance which may be received in the meantime or which are already in place, but are pending) to the designated tab located on the website

● a short, thesis-like summary of the results achieved so far (approx. 4-5 pages following the background - objectives - new scientific results - structure of publications),

● the chosen two Professional Blocks and the 12-12 thematic elements selected from them list.

● a short (max. 1 page) summary of the student’s work written by the supervisor

Examination committee related to the student's research topic and subject exam is appointed by the Doctoral Council, of which the student and his / her supervisor are notified.

The date of the examination is determined by the Doctoral Council (if necessary, additional consultation with the applicant), t

The date will be notified by the Dean's Office to the people concerned. The supervisor is invited to the exam as a non-voting member.