

## **DOCTORAL SCHOOL PROGRAM IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING**

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### **Abstract**

In this paper the recent status of the PhD education in biosystems (agricultural) engineering is shown for Hungary. The legal regulations include the nationwide Hungarian law and Doctoral Council rules along with the university level adjustments. The operating conditions and the main data of the Doctoral School is shown in detail involving the entry, teaching, research, quality assurance and the degree issues. The PhD students recruitment procedure is discussed as it is rather important in the entire process. A special emphasis is given also to the evolution of the PhD structure and especially to the content of the 3<sup>rd</sup> cycle education in the field of biosystems engineering.

### **1. Legal regulations of the doctoral education in Hungary**

#### 1.1 Legislation of the doctoral education

For the doctoral education the law on higher education (Hungarian law, No. CXXXIX, 2005) gives the basic possibilities and duties, and the government established some new regulation about the conditions of establishment a doctoral school and about the terms of the PhD doctoral degree. The national doctoral schools are supervised by a National Doctoral Council, what has its own regulations on the working of the schools. At University level there is a Doctoral and Habilitation Council, who supervises the doctoral schools of the university. This Council has an own regulation for its doctoral schools.

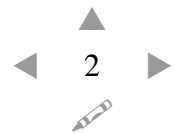
#### 1.2 The doctoral education in Agricultural and Biosystems Engineering

##### General Introduction:

The Doctoral School of Agricultural Engineering (namely Technical Sciences) at the Szent Istvan University was established in 1993 with two specific parts of which one is the "Agricultural Energetics and Environmental Technique" and the other one is the "Basics of Agricultural Engineering". The accreditation of the Doctoral School took place in 2002.

##### Announcing new research topics:

In every year the supervisors submit their new topic proposal until 30 January, after that the Council of the Doctoral School discuss them. Finally, University Doctoral Council decides on them checking also the supervisors' eligibility for some aspects (for example continuous research on the proposed field, publication in the last 5 years with impact factor in the topic). The approved topics are announced in the official homepage of the National



Doctoral Council ([www.doktori.hu](http://www.doktori.hu)) until 31<sup>th</sup> of March, the candidates can choose from there. The deadline for the application is the end of May.

The entrance procedure:

To get to the doctoral education there are several national requirement for the applicants: MSc or equivalent diploma with at least good grade level, at least medium level foreign language (preferably English) exam, at least one year research and some preliminary scientific activity and the proposed field (depends on the school). The evaluation of the applicants is done by the standards of the University Doctoral Council.

The education:

There are different types of education as ordinary students or correspondent (distance education) students. A limited number of the ordinary students are financed by the government.

The duration of the education is 6 semesters, while the students have to collect 180 ECTS credits.

The credits can be got in four educational units.

*Unit I:* At least 40% (min 70 ECTS) of the total credits have to be collected by the exams of the contact lectures. The lectures can be sorted into three groups: A (compulsory), B (compulsory for a specialization) and C (elective - free to chose) subjects.

*Unit II:* Research activity during the educational period. There is a method for the evaluation of this task, which will be discussed later in this paper.

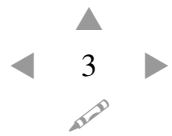
*Unit III:* Teaching activity during the education period. In every semester during the educational period at least teaching two hours per week is compulsory for what two ECTS can be procured. Students taking part in distance education, and have no the possibility for teaching can replace these points by publications.

*Unit IV:* For evaluating the publication activity a score system was elaborated by weighing the different publications.

In Table 1 the minimum/maximum ECTS credits which can be earned from the different educational units are summarized:

Table 1. The min/max ECTS can be achieved from an educational unit

Educational units No.	ECTS credits	
	Minimum	Maximum
<b>I.</b>	<b>58</b>	
<b>II.</b>	<b>70</b>	
<b>III.</b>		<b>12</b>
<b>IV.</b>	<b>40</b>	



The quality assurance system of the doctoral school:

In every 3 years the list of the compulsory and the elective subjects are reconsidered. The main checking points for the doctoral education are as follows:

- For the end of October in the first year every student has to prepare a plan for his/her job.
- For the end of the first year a summary of the Literature overview has to be done.
- For the end of the second years a written research report has to be prepared and defended in a public surrounding.
- For the end of third year a research report has to be taken to the director of the school, which has to be defended in public.

After fulfilment the educational and the research requirements the student can get an "Absolutorium" certificate giving a prove for finishing a stage of their PhD activities.

After getting the Absolutorium, the student can apply for starting the degree process. As a preriquisit they should show an appropriate publishing. During this period the students have to get through on a comprehensive exam, and prepare their Thesis work. In order to submit the Thesis work for final evaluation a good level of internationally recognized publication is needed. In this term the journal publications and the foreign language publications have got higher value. To defend the Thesis work a public meeting is organized with two official reviewers.

In the Table 2 the measure of publication activity is introduced. The minimum ECTS credits has to be achieved by the student is 40.

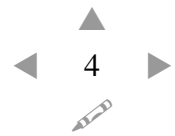
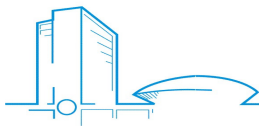


Table 2. The score system of publication activity

Publications and citations		ECTS Credits
Journal	Foreign language journal with if (impact factor)	15
	Reviewed foreign language article	10
	Reviewed Hungarian article	5
	Not reviewed Hungarian article	2
	Other scientific article	2
Conference	International conference proceedings	5
	Hungarian proceedings	3
	International conference abstract	2
	Hungarian abstract	1
Electronic publications	Reviewed, foreign language	3
	Reviewed, Hungarian language	2
Book, chapter	Foreign language book, chapter	6/16 pages
	Hungarian language book, chapter	2/16 pages
	Editor, international	10
	Editor, Hungarian	5
Patent	Hungarian patent	2
	Foreign patent	4
Citation	In Hungarian publications	2
	In foreign publications	5
Technological development, design		2
Technological creation		3
Software development		2

## 2. Structured programs for doctoral education in Biosystems Engineering in Hungary

The educational program for the specification "Agricultural Energetics and Environmental Technique" is detailed in the Table 3. As a notification in the table A means compulsory, B means compulsory for specifications and C means the elective subjects.



Table 3. The educational program for the PhD school

I. year		1. semester		I. year		2. semester	
subject	lecture/ semester	ECTS Credit	subject	lecture/ semester	ECTS Credit	subject	lecture/ semester
general research methodology (A)	30	5	methods of technological research (A)	30	5		
microphysical basics of technological planning (A)	30	5	planning of experiments (A)	30	5		
agricultural energetics (B)	30	4	modelling and simulation of energetical processes (B)	30	4		
teaching activity	30	2	literature analysis	-	20		
			teaching activity	30	2		
total credits:		<b>16</b>	total credits:		<b>36</b>		
II. year		3. semester		II. year		4. semester	
Subject	lecture/ semester	ECTS Credit	Subject	lecture/ semester	ECTS Credit	Subject	lecture/ semester
biophysics (A)	30	5	environmental technique (B)	30	4		
electrical energy management (B)	30	4	Elective subject	30	3		
Elective subject	30	3	research report	-	25		
teaching activity	30	2	teaching activity	30	2		
total credits:		<b>14</b>	total credits:		<b>34</b>		
III. year		5. semester		III. year		6. semester	
subject	lecture/ semester	ECTS Credit	subject	lecture/ semester	ECTS Credit	subject	lecture/ semester
philosophy of technique (A)	30	5	Elective subject	30	3		
Elective subject	30	3	teaching activity	30	2		
teaching activity	30	2	final research report	-	25		
publication	-	30	publication	-	10		
total credits		<b>40</b>	total credits		<b>40</b>		
EDUCATION							58
educational units							
EDUCATION:							58
teaching activity:							12
Research							70
publication:							40
total ECTS credits during the education:							<b>180</b>

*The educational results of the Doctoral School*

The Doctoral School has 73 PhD students in total. The data of government financed students for the last 5 year period is shown in Table 4.

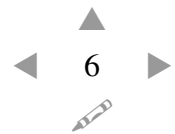


Table 4. The statistics of the government financed students

	2004	2005	2006	2007	2008
The number of the students applied to the School	11	9	15	10	11
From them full time student	4	4	4	3	3
From them how many got absolutorium	7	2	2	-	-
From them PhD degree awarded	1	-	-	-	-
Total PhD degree awarded from the School that year	5	4	5	4	2

From the establishment of the School altogether 63 persons have got absolutorium and, PhD degree were awarded to 52 persons. During the last 5 years 25 persons have got absolutorium and, PhD degree were awarded to 20 persons.

### 3. Students recruitment for the doctoral education in Hungary

#### *More common kind of PhD students*

The data of the recent year PhD graduates is shown in Table 5.

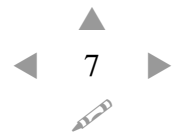
Table 5. The statistics of PhD graduates in 2009

Recent graduates	10
Professionals in companies or Research Centers	4
Foreigners	2
Students participating in 3rd cycle programs with European dimension	1
Students from other European countries	1

#### *Procedure commonly used for recruitment of students*

For the governmental supported education the most of the applicants are from the MSc graduated students of the Faculty, however a part is coming from the Industry (engineers, graduated some years before). In Hungary an official national webpage is operated for providing information of the PhD topics nationwide, however the recruitment of the applicants is done in informal channels (mainly from the MSc students of the Faculty and from industrial and research partners).

In the recent days the School is opens for the international recruitment. At the moment two foreign PhD students are close to finish their thesis work (one Saud Arabian and one Romanian). Additionally, the application of one Indonesian student was accepted, he starts his study from the next semester. As the English language MSc education for foreign students were restarted at the Faculty in 2008, hopefully the number of foreigner PhD students will also increase.



#### 4. Evolution of the structure of doctoral degrees in Hungary

##### 4.1. Short and/or long term changes planned or in-progress

The Doctoral School is now under the accreditation by the National Doctoral Board. It means that the School must fulfil the requirements of Bologna suggestions. It implies that for medium term period there I no significant changes are planned. As it was mentioned before, the most important thing will be the internationalization procedure. More foreign students are expected to join to the Doctoral School (see in Table 6).

Table 6. The changes in progress of doctoral education

Change from traditional unstructured Doctoral studies towards the new Bologna related structured 3rd cycle degree	The Bologna structure is applied now.
Time period for completion of Thesis	3 year study and research period and 2 year completion of the thesis work
Level of difficulty concerning Thesis	Substantially high
More or less internationalization	Efforts should be taken into this action
Other	Strengthen the continuous supervision of the progress of PhD student

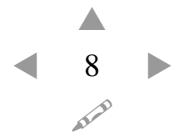
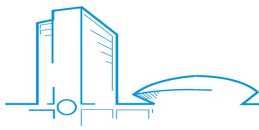
##### 4.2. Developments regarding of European dimension in new 3rd cycle studies

Our Doctoral School is unique in his topic in Hungary, so the cooperation with similar schools in Europe is very important. Even at this semester we have guest lecturers from our partners Institutes having lectures for the students.

Based on the strong international connections we are firmly interested in developing joint PhD courses or double degree program with other European Doctoral Schools. The cooperation developed in our research activity using the facilities of bilateral and EU-funded projects. It could include the use of common research infrastructure and databases (see in Table 7).

Table 7. The European dimensions of 3<sup>rd</sup> cycle studies

Joint degree with other European Institutions, European PhD, etc.	It is planned
Subject areas of common interest	Control of biosystems, use of renewable energy resources
Financial support of European dimension in 3rd cycle degrees	Bilateral and EU supported projects
Combination of European funded projects with 3rd cycle studies	It is already in use
Sharing of infrastructures and research data	Highly expected, partly done
Mobility of teaching and research staff, etc.	Using Erasmus and other funds



### ***5. Evolution of contents of the 3rd cycle degrees in the emerging field***

The relevant topics in Hungary could be as follows:

- Water management and irrigation control
- Solar drying of material of biological origin
- Use of renewable energy sources in bio-systems
- Development of biosensors
- Control issues of bio-system engineering

### ***6. Establishment of a European Doctorate in Biosystems Engineering***

We consider that the also the expansion of national programs to a joined program, or a newly established European doctoral program would have numerous benefit for all participants, for example unified expectations and course materials, etc.

#### **References**

Farkas,I.: Definition of the emerging biosystems engineering discipline in Hungary, Proceedings of the 1st ERABEE Workshop, /ed. by D. Briassoulis and P. Panagakis/, Madrid, Spain, April 3-4, 2008, pp. 72-76.

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