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Acoustic engineering in the European Higher Education Area. Development of a Spanish post-degree

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ABSTRACT

Traditionally, Acoustic engineering has been marginalized in the Spanish university system. The present process of change of the degrees map and the Spanish university system and its adaptation to the European Higher Education Area are opening new possibilities of development on this aspect. The process road map has initiated by the reform of the superior degrees, having be the present course 2006/07 the first course in which degrees adapted to the new system have been working. The University of Leon (in collaboration with another Spanish university), of pioneering way in Spain, has led the beginning of a specific degree of post-degree about Acoustics Engineering. This paper analyzed the structure and the organization of this degree..

1 INTRODUCTION TO THE EUROPEAN HIGHER EDUCATION AREA

The 25 of May of 1998, the Ministers of Education of France, Germany, Italy and United Kingdom signed in Sorbona a declaration in order to the development of a "European Higher Education Area". During this meeting was accorded the possibility of another meeting in 1999, considering that the Declaration of the Sorbona was only a first passage of a political process of long term change of superior education in Europe.

The second passage is arrived thus at the celebration of a new Conference: the Declaration of Bologna the 19 of June of 1999. This Declaration had a greater participation than the previous one, being subscribed by 30 European States: not only the countries of the UE, but also countries of the European Space of Free Commerce and countries of the east and center of Europe.

The Declaration of Bologna builds the bases for the construction of a "European Higher Education Area", organized according to certain principles (quality, mobility, diversity, competitiveness) and oriented towards the attainment among others of two strategic targets: the increase of the use in the European Union and the conversion of the European university system in a pole of attraction for students and professors of other parts of the world.

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Six objectives are gathered in the Declaration of Bologna:

1. The adoption of a legible and easily comparable system of degrees.
2. The adoption of a system based, fundamentally, in two main cycles.
3. The establishment of a system of credits (ECTS).
4. The promotion of the European cooperation to assure a comparable quality level for the development criteria and methodologies.
5. The promotion of a necessary European dimension in the superior education with particular emphasis in the curricular development.
6. The promotion of mobility and removal of obstacles for the free exercise of the mobility by the students, professors and administrative personnel of the universities and other Institutions of European superior education.

The Declaration establishes a term until 2010 for the accomplishment of the European Higher Education Area.

2 FIRST LEVEL: DEGREE

The objectives of the official degree level will have, with general character, a professional direction, that is to say, degrees will have to provide a university formation in which are integrated: the generic basic contents, the cross-sectional contents related to the integral formation of the students and the contents more specific than make possible a professional direction in order to an integration in the labour market. In this respect, it will be essential in the process of design and elaboration of Degree level not only its harmonization with the degrees consolidated in other European countries in each one from the scientific, technical and artistic scopes, but the collaboration between the academic community throw the associations and Professional Schools.

The first level will give rise to the official title of Lawyer, Engineer or Architect. Its obtaining will require to have obtained 240 European credits.
The requirements for the obtaining of the official university titles of degree, and the general directives of the curricula, will be established by the Government, or by his own initiative, previous report of the Council of University Coordination, or to proposal of this Council.

3 SECOND LEVEL: POST-DEGREE

In agreement with the Declaration of Bologna, the second level of the university system, for whose access it will be required to have surpassed the first level (degree), will allowto the obtaining of the titles of Magister and/or Doctor. In Spain they are regulated by the law RD 56/2005, of 21 of January, about the official university studies of Post-Degree, modified by the law RD 1509/2005.

In the design of the structure of this level diverse options exist that are effective in other countries. All of them have advantages and disadvantages. In general, it can be useful to establish that Masters-Doctorates structure has a sequential character, with the access to the period of elaboration of the doctoral thesis only after obtaining the title of Master in a post degree program. In any case, this exigency would be necessary in the Masters not oriented towards the investigation, and strictly professional.

The Universities, after the elaboration and approval of the postgraduate programs by the way indicated in its Statutes, will have to ask for the report of the competent Independent Community and to send them to the Council of University Coordination for their homologation.

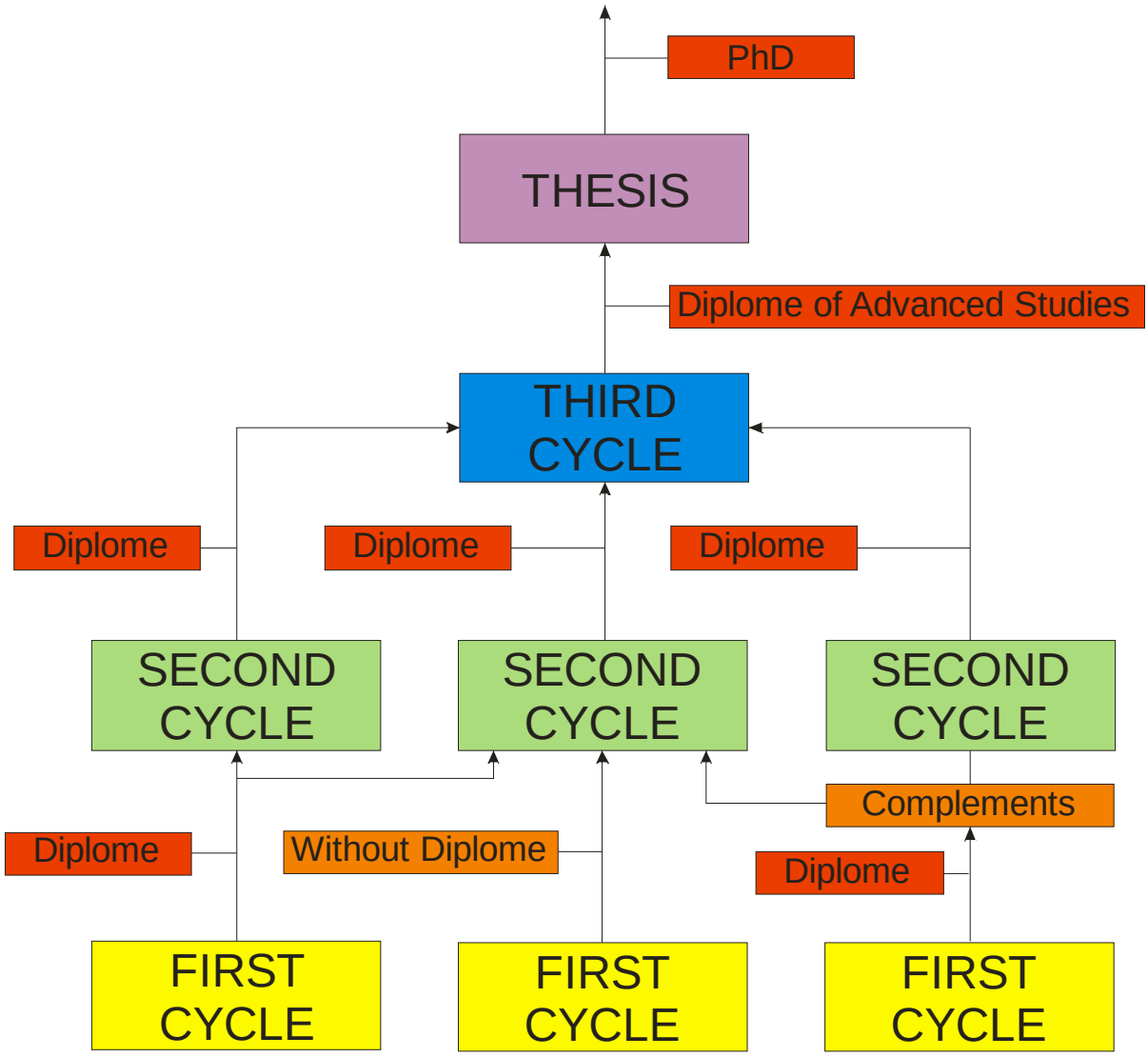

Figure 1: Old structure of the Spanish university system.

3.1 The official diploma of Master

The election of the denomination of “Master” for the post degree titles has doubtless advantages because is more generally used in other university systems of the European Union.

The formatives objectives will be more specific than those of Degree and will have to make possible a greater academic development and a scientific specialization: towards the investigation or towards advanced professional formation.

The obtaining of the title of Master will require to have completed between 60 minimum of European credits and maximum of 120, based on the previous formation and on the investigating, scientific or professional direction that have each one of these studies of post degree.

The programs must have a flexible structure and a system of recognition and different conversion that allow the access from formation previous. The contents of these degrees will have to be defined based on the scientific and professional competitions to acquire. An

account of the diversity and specialized character of these postgraduate studies and in order to favor the flexibility for adapting to the changes, the Government will regulate the general requirements of these studies, but will not establish general directives on their contents.

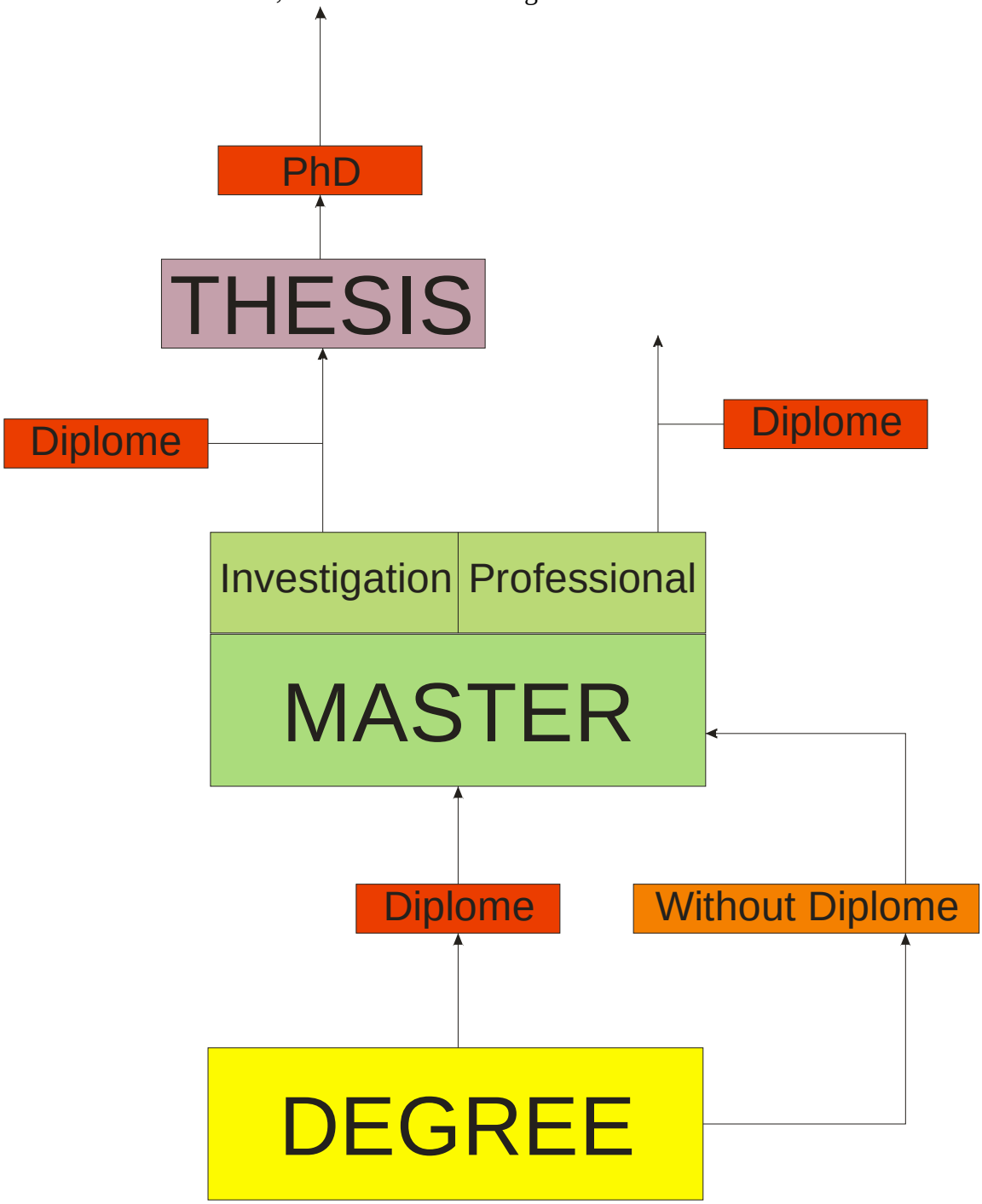

Figure 2: New structure of the Spanish university system.

3.2 The title of Doctor

Between the main targets of the propose reform one of them is the revaluation of the doctorate studies and the improvement of the levels of excellence in the academic superior degree. The future of the Spanish university system needs an increase of the levels of competitiveness of these studies, which make them attractive at international level, as well as more recognition of the formation that provides on the part of companies and nonacademic institutions.

4 EXPERIENCE OF THE UNIVERSITY OF LEON: MASTER IN ACOUSTIC ENGINEERING AND VIBRATIONS

4.1 Objectives

The influence of the noise and the vibrations in relation with the quality of life in our present society is evident. The search of the acoustic and vibratory comfort more and more is appreciated and passes through a good design of spaces and quiet machines.

Table 1: Master Structure

Subjecs	Type	Module	ECTS
Weeks 1 to 7			
Mathematical methods in Acoustics and Vibrations	Ob	Basic Principles	3
Propagation of the Sound	Ob	Basic Principles	1
Physical Acoustics	Ob	Basic Principles	3
Basis of Vibrations	Ob	Basic Principles	2
Insulation, Materials and CTE	Ob	Architectonic Acoustics	3
Processing of the Signal	Ob	Basic Principles	3
Weeks 8 to 15			
Instrumentation of Acoustics and Vibrations	Ob	Basic Principles	2
Elaboration of Acoustic Maps	Ob	Environmental Acoustics	3
Measurement and Evaluation of the Noise	Ob	Environmental Acoustics	3
Management of the Environmental Noise	Ob	Environmental Acoustics	2
Techniques of Intensimetry	Ob	Architectonic Acoustics	2
Acoustics of Rooms	Ob	Architectonic Acoustics	3
Weeks 16 to 24			
Characterization of Sources of Noise: Acoustic Power	Ob	Industrial Acoustics	2
Control of Noise and Vibrations	Ob	Industrial Acoustics	2
Norms and Legislation about Noise and Vibrations	Ob	Environmental Acoustics	1
Labour Noise and Vibrations	Ob	Industrial Acoustics	3
Acoustic Radiation of Systems: Numerical Methods in Industrial Acoustics	Op	Industrial Acoustics	2
Mechanic Vibrations in Continuum: Modal Analysis	Op	Industrial Acoustics	2
Evaluation and Certification of Insulations: Tests	Op	Architectonic Acoustics	3
Musical acoustics	Op	Architectonic Acoustics	2
Acoustics of Theaters	Op	Architectonic Acoustics	1
Effects of the Noise and Vibrations on the People	Op	Environmental Acoustics	1
Diagnosis of Noise and Vibrations in Machines	Op	Industrial Acoustics	2
Acoustics and Arrangement of the Territory	Op	Environmental Acoustics	2
Report of Environmental Impact by Noise and Vibrations	Op	Environmental Acoustics	2
Weeks 25 to 30			
Final Project / Companies Training	Ob	Projects	15

The primary targets of this Master are:

- Technical formation in order to the student develop all the functions stipulated in the Law of the Noise (37/2003) and in the future Technical Code of Construction (CTE), as well as the laws that promulgate the Autonomous Communities and decrees of the city councils, in the field of the Acoustics and Vibrations.
- Preparation for the elaboration, programming, management and execution of studies, information, opinions and projects or similar, in the scope of the Acoustics and the Vibrations, as well as for the participation in committees of normalization, specialized commissions, agencies of evaluation, etc.
- Scientific and technical formation, relying on the parameters of quality and exigencies expressed in the criteria established in the European Higher Education Area.

4.2 Public and contents of the Master

The Master is oriented to: graduated in Physics, Mathematics, Chemistry, Environmental Sciences, Architecture and Engineering.

The contents of the Master are structured in five modules:

1. Basic Principles of Acoustics and Vibrations.
2. Environmental Acoustics.
3. Acoustics Architectural.
4. Industrial Acoustics.
5. Final Project or Practices in a Company

5 MASTER STRUCTURE

The Master is made up of 60 credits ECTS, of which 15 correspond to the Final Master Project. The 45 remaining credits are distributed, of approximately equality form, between 4 modules with obligatory subjects (38 credits) and optative subjects (17 credits). The global supply of credits is of 70 credits, distributed in two semesters.

Because is an interuniversity master between the University of León and the University of Valladolid, the teaching of theoretical subjects is imparted by means of the videoconference system, with video conference classrooms in each university, in function of the proceeding university of the professors.

The practical part of the subjects will require the physical presence of the students in the laboratories, so, in this case, the videoconferences system is not possible, being necessary the transfer of the students between the universities.

In this way the interchange of experiences is facilitated, allowing to the students to know different cities, different universities and different manners of working in a same course.

The coordination of the Master is carried out by two coordinators, one of each university.

6 CONCLUSSIONS

Other centers of Superior education in Acoustic Engineering in Europe exist, for this reason is easy to deduce the good health that has these studies in Europe.

Certainly, in some of these centers the title in Acoustic Engineering implanted is the Degree, but also in many of Postgraduate studies in Europe the Acoustic Engineering is imparted in Masters or Studies of Doctorate.

In Spain, an Acoustic Engineering Degree does not exist, but in other Spanish universities initiatives have been taken to satisfy a demand, more and more increasing, in this field. Proof of it is the existence of own titles in many universities.

The Masters is just within the European Higher Education Area, and we believe that this Masters in Acoustic Engineering responds necessarily to the criteria established in the process of convergence initiated in Bologna in 1999, fulfilling the strategic target of this declaration at the time of contributing to the academic, professional and investigating specialization in the field of Acoustic Engineering.

7 COLLABORATIONS

Some of the participant companies in the master are:

Alava Ingenieros: Importer with solid international alliances in the matter of environmental noise, vibrations, and hygiene. Participation in seminaries on equipment and software and perspective in acoustic instrumentation.

Audiotec: Collaboration in specialized seminaries on real performances and accomplishment of practices. Given his expanded to experience in the enterprise scope of the acoustics and its vocation in harnessing line I+D and the collaboration lent in the accomplishment of projects as well as its contribution in company practices it will be very useful for the pupils.

Brüel & Kjær: Brüel & Kjær collaborates in the master in courses and seminaries with sessions on the measurement instruments as well as seminaries and practices.

CESVA: Spanish manufacturer of acoustic precision instrumentation. Participation in chats and seminaries on instrumentation and acoustic measures.

IberAcústica: Collaboration in seminaries, chats and accomplishment of practices. Accomplishment of Final Master Projects.

pdAudio: Participation by its experience in strategic maps of noise and installation of control networks.

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