

## ***Graduate school of Nancy - Saint-Etienne: curriculum organization***

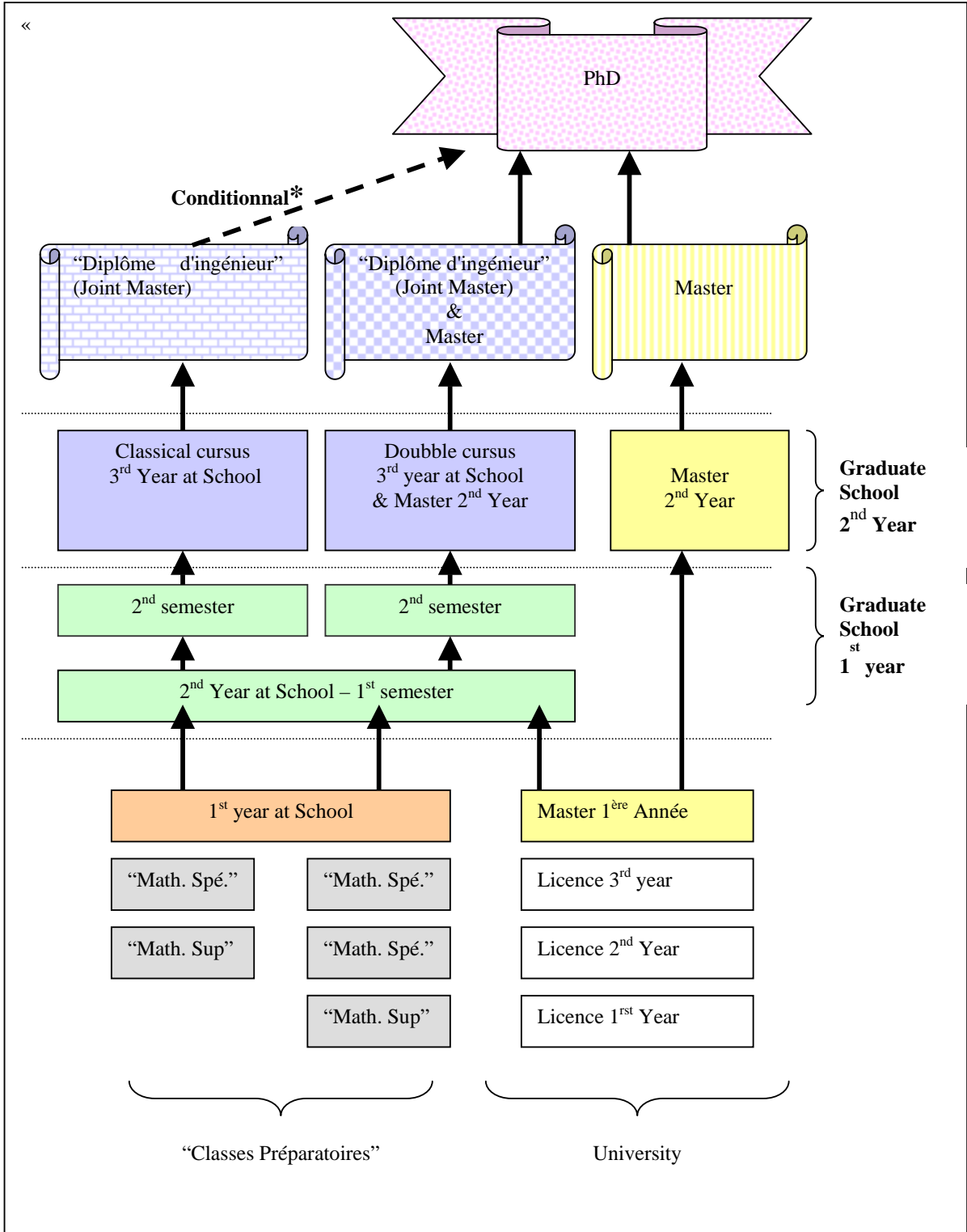
European countries are currently constructing a common higher education system. The Bologna declaration of June 1999 specified that each country should adopt a higher education system based on two university levels. The first is defined as undergraduate studies, lasting a minimum of 3 years and subsequently allowing students to work in the European professional market. The second is Graduate studies consisting of a Masters and then a possible PhD.

In accordance with these stipulations the MINES offers a variety of choice in Graduate programs, which result in 3 types of diploma:

- **PhD**, only available to those students already having completed a Masters program
- three types of Masters programs
  - The “**Diplôme d’Ingénieur**” which is a **Joint Master (JM)**. The student studies two majors, one of a technological nature of the student’s choice and the other of a methodological nature within the field of Executive Engineering
  - a **Master of Science (MS)**, which is the precursor of a PhD (the student can follow this program while studying for certification as a professional engineer)
  - a **Master of Science in Engineering (MSE)** which is a specialised course for those students who already have a Master’s or Bachelor’s Degree and previous professional experience.
- “**Mastères spécialisés**”

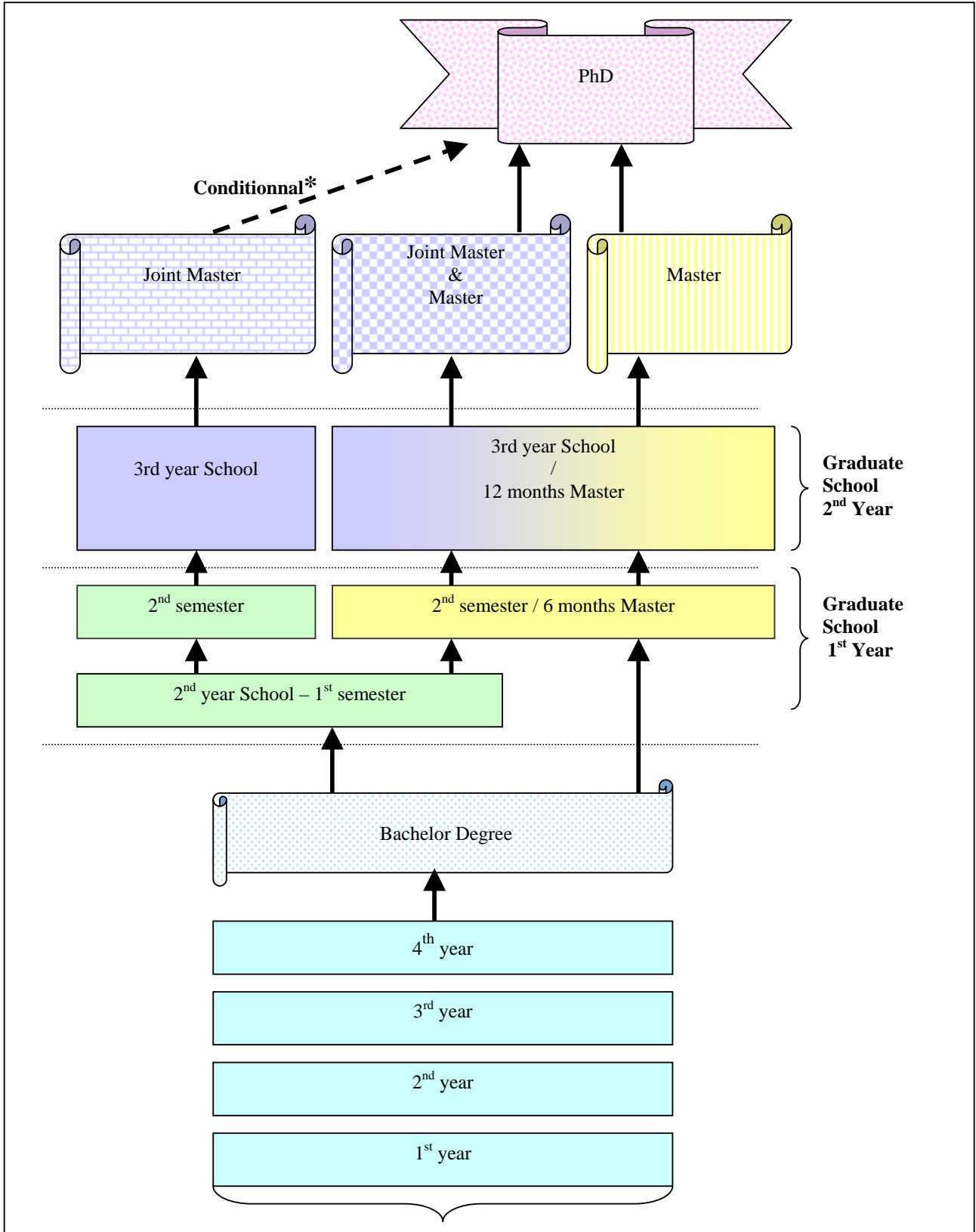
This is a post-masters course labelled “*Mastère spécialisé*”. It consists of 400 hours of academic study followed by a work placement (industrial thesis).

The following diagrams 1 and 2 illustrate how students gain access to the different programs (JM, MS, and PhD) offered by the Graduate School. Diagram 1 concerns French and European students, while diagram 2 applies to non-European students.



\* with a compulsory of a research Graduate project

Diagram 1 : access to the GS for french and european students



## Diagram 2 : access to the GS for non-european students

### III,1) THE “DIPLOME D’INGÉNIEUR CIVIL DES MINES” – JOINT MASTER

#### OBJECTIVE OF THE JM

The objective of the studies leading to the "Ingénieur Civil des Mines" Diploma is to train high-level professionals known in French as "ingénieurs généralistes." The holder of a MINES Joint Masters, henceforth be referred to as an "Ingénieur" is expected to design, set up, organize and manage large-scale industrial operations in an increasingly globalized social and economic environment. The "Ingénieur" is familiar with the methods and tools used to manage projects and is therefore intended to join the ruling elite of French and international companies. He or she is able to function in all fields of activity: computer science, car manufacturing, aeronautics, energy, metallurgy, banking, insurance, consulting, engineering, auditing, etc. All these sectors, however, are faced today with the formidable challenge of globalization, which opens new avenues for our economies but also generates paralyzing contrasts. The organizational culture of the company is put to the test by the amazing fluidity of information exchange, which exacerbates the differences between interlocutors and strains communication. A case in point is the use of electronic mail, which provides immediate access to information, radically changes staff relationships, and consequently upsets the organization of the company.

Before stating what a fully qualified "Ingénieur Civil des Mines" is, let us make clear what he/she is not! He is not a professional who has been overfed with wide-ranging academic study and is consequently and supposedly familiar with many techniques and therefore capable of adapting to any field if need be. Our concept favors an integrated approach rather an accumulation of knowledge because companies do not need engineers crammed with encyclopedic knowledge but professionals able to understand the customer's needs, to manage teams, choose the technological solution that best suits the context, foresee the production problems that the design of a product can generate, take into account the possible consequences on the environment and consequently the life span of a product, and finally be able to define the strategy of the company.

Such challenges can only be met if the academic training of the student is accompanied by field experience and situation analysis. That is why projects, studies, consulting, industrial internships are increasingly developed. They allow the student to have a multi-dimensional approach and enable him/her to take into account and analyze all the factors involved.

Finally, the training of engineers aims at meeting two requirements. The first priority is to endow our Graduates with state-of-the-art skills that will give them prime access to the job market. This is the main goal of the Technology Major. The second priority is to prepare them for careers that will increasingly involve managerial responsibilities. This is achieved through a broad-spectrum curriculum leading to the Major in Executive Engineering which, together with the Technology Major, make up the certification as a professional engineer.

#### THE STUDY PROGRAM

Two types of programs are offered:

- **The integrated five-year cycle:** accessed through a highly selective competitive examination, since only 5% of the best scientific students in France are admitted. In compliance with the Bologna European Convention, this cycle covers two phases:

The undergraduate cycle starts with a two-year intensive mathematics and physics curriculum, followed by a year at the School, which is essentially devoted to developing skills in such scientific subjects as computer science,

probability, fluid mechanics, as well as applying previously acquired knowledge to the field of engineering, and introducing management skills. By the end of the undergraduate course, the students have acquired a solid background in mathematics and physics, since 1200 hours are set aside for these two subjects.

The superior cycle is followed in the Graduate School. It begins in September and lasts for three semesters plus two summer sessions during which the students work on the two projects validating their placement in industry. Completing the projects is required for certification as a professional engineer.

- **The two-phase cycle:** Holders of a Bachelor's Degree or an equivalent diploma obtained in another university may also apply to the Graduate School. Upon admission they follow the same studies as the students of the integrated cycle.

### **THE TECHNOLOGICAL MAJOR**

This Major is equivalent to those taken by students studying towards a Master in any university (chemical engineering etc.). Altogether, eleven Majors are offered by the five departments of each MINES School. The students study towards these Majors for part of the first year and most of the second year. The last twenty weeks of the course are spent working on the Graduate Project. In most cases, this project work is done in industry. See the paragraph IV,2 of this chapter.

### **THE EXECUTIVE ENGINEERING METHODOLOGICAL MAJOR**

This is the Major that makes the diploma really unique. It focuses on the methods and tools used in industrial and system engineering as well as on management and general skills. Innovative teaching methods aim at simulating real-life situations. A small portion of these courses are attended by all the students. Included in this Major is a ten-week assignment as an assistant engineer. This Graduate project is often carried out abroad.

### **AN OPEN CURRICULUM**

The curriculum aims at meeting two objectives (which may turn out to be contradictory). On the one hand, it is very important that the curriculum should correspond to the student's wishes, although these may vary considerably from one student to the next and sometimes even lack coherence. On the other hand, the skills acquired by the student must be in keeping with the objectives advertised in the program so that the Graduate meets the demands of industry. Several tools are used in order to make sure that the students' choices are appropriate :

All the students in an entering class have to take the core-curriculum courses.

The courses offered by the Graduate School are devised in such a way that students acquire not only academic knowledge but also professional skills.

Courses can only be combined to a certain extent. This is particularly the case for the Technological Major, which may even leave no room for any choice.

These questions are usually solved on an individual basis, bearing in mind that admission to the Technological Major is effective from the first or the second semester of the second year in the Graduate School. All changes in the curriculum have to be approved by the student's adviser, who then submits them for approval to the Dean of Studies.

### **ADMISSION REQUIREMENTS**

The "Ingénieur Civil des Mines" certification is a high-level diploma and is therefore intended for students holding a scientific Bachelor's Degree, since a very good level of mathematics and physics is required. (see undergraduate program in appendix)

### **LANGUAGE USED**

The classes are mainly in French.

### **SUMMARY**

The "Ingénieur Civil des Mines" diploma is a Joint Masters comprising two Majors:

- A Technological Major chosen in the first or second semester in the Graduate School and offering several concentrations.
- An Executive Engineering Methodological Major, which is unique in its kind and includes courses taken by all the students in the year group.

## **III,2) MASTER OF SCIENCE IN ENGINEERING**

The MINES Schools offer programs leading to the Master of Science in Engineering. Each of these programs is described in chapter two.

### **OBJECTIVE OF THE MSE COURSE:**

The MSE course leads to a specialized diploma and is intended for holders of a Masters of Science or an equivalent Degree. It can either provide extra grounding or help students to re-enter professional practice.

### **PROGRAM CURRICULUM**

It covers two semesters, amounting to about 600 hours of academic study, followed by a twenty-two-week industrial placement leading to a research paper. The student chooses his electives with the help and agreement of his adviser. (Most courses are compulsory). The program begins in September.

### **ADMISSION REQUIREMENTS**

Applicants to the MSE course have to hold a Masters of Science or a Bachelor of Science combined with at least three years' professional practice.

### **LANGUAGE USED**

Depending on the MSE chosen, the classes are either in English or in French.

## **III,3) MASTER OF SCIENCE**

In partnership with other universities or colleges of engineering, the MINES Schools provide courses leading to an MS, known in France as a Research Masters. Chapter 2 recaps and describes all the Masters offered by the MINES Schools.

### **OBJECTIVE OF THE MS COURSE**

This MS course is the first step towards a doctoral dissertation (or: Phd). It is a doctoral program run by a MINES School and several partner universities or colleges of engineering. It should be noted that the MS also allows the student to enter professional practice.

### **PROGRAM CURRICULUM**

The course covers two semesters amounting to 450 hours of academic study and includes two summer sessions. The first summer session is an introduction to research work and to its connection to business. The second concludes the program. It is devoted to a twenty-two-week project usually carried out in the laboratory of a company or sometimes even in the laboratory of a MINES School. This project familiarizes the student with research work. The student chooses his electives with the help and agreement of his adviser, depending on the career considered. It should be noted, however, that most courses are compulsory.

### **ADMISSION REQUIREMENTS**

A Bachelor's Degree and sufficient income to support themselves are required of all applicants. Candidates are admitted on the basis of their academic record after going through an audition by a jury. Only ten to twenty students are admitted through this procedure.

### **LANGUAGE USED**

The classes are mainly in French.

## **III,4) POST-MASTERS NON DOCTORAL PROGRAM**

A post-Graduate course can be taken at MINES Nancy. It consists of 380 hours of academic study followed by an industrial placement leading to an industrial thesis. The diploma, known as a "Mastère Spécialisé," is recognised by the Board of Engineering universities ("Conférence des Grandes Ecoles").

### **OBJECTIVE**

The "Mastère Spécialisé" is a highly specialised Degree intended for holders of a Master of Science Degree. It provides extra academic grounding and can, in some cases, help students to re-enter professional practice

### **CURRICULUM**

It covers two semesters and usually consists of about 400 hours of academic study, followed by a twenty-two week industrial thesis carried out with a business partner. The course starts in September. The student chooses his electives with the help and agreement of his adviser, depending on the career considered. It should be noted, however, that most courses are compulsory.

### **ADMISSION REQUIREMENTS**

The "Mastère spécialisé" diploma can be accessed by students holding a Masters or a Bachelor's Degree and having least three years' work experience.

## **III,5) PHD**

The Doctorate or PhD is a Degree granted by universities, "écoles normales supérieures" and other public institutions of higher education entitled by an order issued by the Ministries of Higher Education and Research. MINES Doctoral studies are pursued in Doctoral Schools gathering institutions such as universities and engineering Schools having the same geographical location. These studies lead students holding a Master of Science – also called "Master Recherche" – or a DEA towards a Doctoral dissertation. A Doctoral dissertation is ideally completed within a span of three years. Unless the results of the research are confidential, they should be regularly published in renowned international journals.

### **ADMISSION REQUIREMENTS**

The applications submitted by the research teams are received by the director of the Doctoral School once they have been approved by:

The director of the laboratory or the research center where the Doctorate will be completed

The university professor who will supervise the research.

The applicant is also required to have a scholarship that will allow him to support himself all through his Doctoral study.

### **Standard admission procedure**

In order to enroll for a Doctorate, the student must have received a Master of Science geared towards research (also known as Master Recherche in France) If the student holds a Master's Degree in another scientific field than the one in which he is going to do the research, he must be authorized to pursue his research by the professor in charge of the Master of Science corresponding to his research subject.

### **Dispensatory procedure**

If the above-mentioned requirements are not fulfilled, a candidate may enroll provided he has received an equivalent Degree. This procedure also applies to students having studied towards a Master's Degree abroad or having relevant professional practice.

## **CURRICULUM**

The optimal duration of the PhD is 3 years. Relationships between the different partners of the thesis : Doctoral candidates, mentors and administration have an engagement and a thesis contract which resembles a certain number of recommendations to the usage of different partners involved by the enrichment of the Doctorate thesis and concern all the Doctoral candidates, Professors and researchers here at the “Ecoles” de MINES.

This Engagement leads to a serious involvement in the different partners involved in these doctoral studies and define better the roles and responsibilities of each one throughout the length of the thesis. It is flexible in its applications in order to take into account diversity of each of these institutions and hence opens the way to internal adaptations focusing to complete or precise certain of their characteristics. It is the object of the thesis contract.

The doctoral training, outside of research work, is divided into three sectors : scientific training destined to give the students required knowledge to complete his research work, an interdisciplinary training allows the acquisition and the mastering of communications skills or self-expression, and the rights of intellectual property. Moreover, this training prepares the student to his own professional integration either in higher education or in social and economic areas.

The entire education is mandatory ; it is followed during all of the doctoral cursus for every students of the Doctoral School. The authorization of defense of the PhD cannot be given to doctoral candidates who has not fulfilled his obligations of studies.

## **DEFENSE OF THE THESIS**

The doctoral advisor in charge of the training establishes the composition of the jury, mentioning clearly the names and titles of the President and the referees. In addition, he sends this composition for approbation to institutions for verification.

The required documents for the defense (the proposition of the jury must be signed, the defense certificate report must be prepared, the advice of the jury for printing the thesis given and the defense report authorized) are sent to thesis director with those sent to candidate. This fills out the registration requirements, which are then computerized with the aid of our library. They must be joined by three exemplars or the thesis submitted to the secretary of the doctoral school.

The defense is public (except in case of confidentiality linked to industrial contracts). The acceptance or the rejection is pronounced after the jury deliberation. The acceptance gives the possible judged levels: « *cum laude*, *magna cum laude* or *summa cum laude*”. The President of the Jury establishes a defense report, which is countersigned by every member of the jury. He transmits an evaluation on the possibility of reprinting the thesis as is or after corrections.

## **I) Teaching methods**

As all GEM universities, MINES universities promote original educational methods which enable students to meet the companies' expectations efficiently once they have obtained their diploma. These educational methods have already been discussed in the general introduction. Nevertheless, MINES universities have specific features.

## **1) COURSES**

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As far as the master's program is concerned, fewer than 40 students enroll on 90% of the courses. Besides, there are no more than 20 students in most courses.

## **2) THE GRADUATE PROJECTS**

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The master's Degrees prepared in a MINES university are completed by a Graduate Project which is carried out during the summer session.

For Masters of Science or R&D Joint Masters, this project consists in research work in an industrial laboratory. Students thus have a first experience in research. At the end of the project, students have to write a report and give an oral presentation which will be assessed by a jury. The project is both an introduction to research and a selective admission test to the PhD program.

For MSEs and other JMs, the Graduate project is similar to a real industrial project. Students also have to write a report and give an oral presentation assessed by a jury. However, students should be assessed as if they were actual engineers. To do this project, students are usually part of a company and are supervised by a university teacher and someone in the company. Since students have to address a current problem in the company, they generally develop managerial skills in addition to technical and scientific skills.

Finally, JM students have to prepare a second Graduate project during the first summer session in order to have a major in Executive Engineering.