




Apprenticeship/vocational training program for Engineering education in France

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Introduction.

■ Institut Mines-Télécom :

- The French Hi-Ed & Research institute dedicated to Innovation, Management, Technology.
- Federating the Graduate Engineering Schools of the [Ministry of Industry and Digital Technology](#).
- ~14.000 students (10.000 graduate students + 1.700 PhD students).
- 7% of all Master of Science in Engineering degrees issued in France - **#1**
- € 400 million Budget, € 100+ million in corporate research / year - **#1**


■ 3 missions :


- Higher education : to train world class graduate students in the fields of ICT, engineering, and management.
- Research : advanced research activities to source the “high-tech industrial and digital society”.
- Innovation: to be active in economic development through technology transfer, start-up creation and support to industry.

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Introduction.


■ Ecole des Mines de Nantes :

- 2 main domains :
 - Computer sciences, information technologies / Industrial engineering and automatic control.
 - Environment, energy and process engineering / Nuclear engineering.
 - Integrating the dimension of Economics, management and social sciences.
- 130 permanent faculty (20% international), 30 M€ overall budget.
- Higher education : 1200 students. 4 programs :
 - Master of Science in Engineering : 5-year integrated Master's level in engineering, taught in French.
 - Masters of Science (MSc) in French.
 - 3 International Masters of Science in English.
 - PhD (~120).
- Research : 4 research departments, ~200 publications in papers / year.
- Innovation : >9 M€ research contracts.

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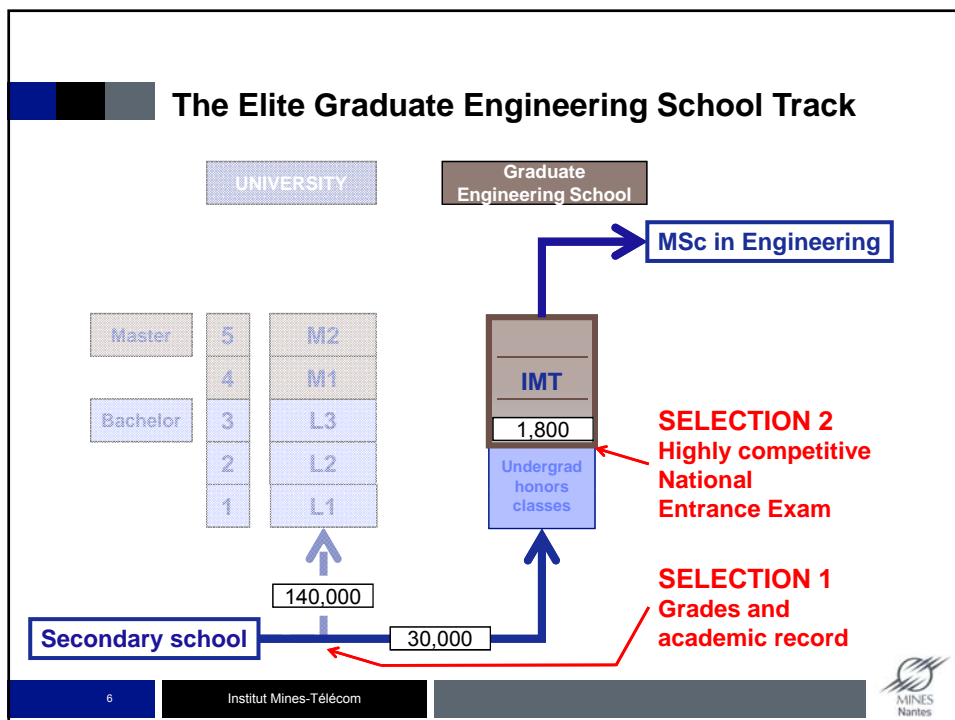
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Engineering education in France.

- Engineering is taught in 240 French Institutes for Engineering : Elite Graduate Engineering Schools named « Grandes Ecoles » in French.
- Education in these Institutes is a blend of :
 - Broad-based studies in sciences
 - Engineering
 - Management
 - Social and human sciences
- Provide a high professional status, lead to top positions and open up a wide variety of career possibilities.

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Part-time curriculum or apprenticeship/vocational training ?

■ In a part-time curriculum :

- Designed for people already working, so as to give an opportunity to further their studies on a part-time basis.
- Previous status = mainly employee.
- Mostly built up from an existing full-time program (same degree).
- Loose coupling between work-time and school-time.

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What is apprenticeship training ?

■ In a French engineer apprenticeship/vocational training program :

- Degree apprentices also have full-time employment status, but are recruited specially for the apprenticeship training program.
- Previous status = student.
- Programs are co-designed between partnership industrial companies and higher education institutions.
- Time in the firm is part of the training program !
- Apprenticeship training program can be related to a full-time program, but in most case they are independent programs.
- Recruitment based on other criteria than the national student admission exam leading to the full-time program : less academic, more technical.
- 11% of Elite Graduate Engineering School's alumni followed an apprenticeship curriculum.

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Engineering apprenticeship training at Institut Mines-Télécom (IMT).

- **1 / 6** of all engineering degrees issued in France from an engineering apprenticeship training program are from IMT - **#1**
- **17** training programs : management, software engineering, nuclear power plant engineering, mecatronics, energy, etc.
- **~1700** apprentices in training programs.

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Focus on Ecole des Mines de Nantes.

- **2 MSc in Engineering degrees** = 5-year integrated Master's level Engineering degree.
 - Main engineering degree (from 1993) : broad thematic field (computer science, energy, automatic control, etc.).
 - New engineering degree (from 2014) : specialized in software engineering, on an apprenticeship basis.
- **Why create this new training program ?**
 - General lack of engineers in software engineering in France.
 - Strong demand around Nantes for high qualified engineers, where software companies are numerous.
 - Our mission is to support industry development.
 - Social diversity of students.
- **We decided to work on it from 2008.**


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Mines Nantes apprenticeship program


- **High quality apprenticeship program :**
 - Designed with the same requirements as the one for our main program.
 - High requirements in Fundamental Sciences and English.
 - From practice to concepts.
 - Similar requirements for an international internship (9 weeks).
 - Strong links with our research activities :
 - Teacher-researcher faculty.
 - Credit unit on research awareness.
- **Strongly supported by social sciences :**
 - 2 hours of computer science, 1 hour of social sciences.
 - So as to give them a broad point of view on the computer engineer profession.

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Mines Nantes apprenticeship program

- **Curriculum :**
 - 1800 hours.
 - 3 years : last year of undergraduate + 2 years post graduate (Master).
 - Engineering sciences : 19%.
 - Software engineering : 43%.
 - Social sciences : 20%.
 - Languages : 10%.
 - Personal project, international : 8%.

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Built for and with industry.

- **Built and operated in strong relation to the software industry :**
 - For 25 new apprentices each year, between 60 to 80 software Industry's offers.
- **Built and operated with our partner, ITII Pays de la Loire :**
 - An institute created with the Regional Council, the professional branches and high education institutions.
- **Part-time school / firm all along the program :**
 - 50% of the 3 year program takes place in partner's companies.
 - Rate of alternation varies according to years : 1 month in first year, 2 months in 2nd year, last 6 months in the partner's company.





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Built for and with industry.

- **Time in the partner company is part of the program :**

Year	Key skill	Rythm	Position	Comments
Y1 Last year of undergraduate	Listen Observe Analyse	1 month	Acculturation to the firm Advanced technician	The apprentice is operational from his/her previous computer skills and can perform mini-projects
Y2 Master first year	Convince	2 months	Implication in projects Engineering in training process	The apprentice takes responsibility in the company's activities
Y3 Master second year	Animate	6 months	Project management Starting engineer	The apprentice engineer at the end of cycle is autonomous and can lead an engineering project



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How to train an apprentice ?

- **At Mines Nantes**
 - The apprentice continues his academic training : new knowledges, including transversal.
 - Academic validation (credit units, etc.).
- **In the firm**
 - He/she builds his/her competence by putting it into practice.
 - This process is a progressive one : from real life situations to engineer missions.
 - With a close follow-up.
- **Tutoring team :**
 - The Industrial Tutor : he/she guides towards the position of engineer. He/she is himself an engineer.
 - At ITII, an Industrial Advisor : he/she helps the company to ensure that it plays its part in the training properly.
 - At Mines Nantes, an Academic Tutor, from Year 2 : he/she guaranties the scientific level.

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How to train an apprentice ?

- **Back and forth between school and industry**
 - The apprentice, midway between two worlds, is able to take a step back from its activities both in school and in business.
 - In this step back from his/her own experiences, he/she learns how to learn, from the materials at his disposal.
- **An excellent but demanding training program !**

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Towards IMT Atlantique...

- New Elite Graduate Engineering School of the minister of Industry, part of the Institut Mines-Télécom (IMT).**

 - IMT Atlantique = Mines Nantes + Telecom Bretagne.
 - From the 01/01/2017.
- Our ambition : ASSOCIATE DIGITAL & ENERGY TO TRANSFORM SOCIETY AND INDUSTRY.**
- Key figures :**

 - 2300** students (among them 1400 Master of Science in Engineer's students and 300 PhD).
 - 730** post-graduates per year, among them 80 PhD.
 - 290** faculty members.
 - Top 10** among french Grandes Ecoles for research activities.
 - 2** engineer apprenticeship training programs.

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