Experience of an industry-oriented Master degree in France based on a strong research and international background

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Outline

1. European “Bachelor Master Doctorate” system
2. Master “Automatic Control & Electrical Systems”
3. Master option “Smart Electric Vehicles”
1. European “Bachelor Master Doctorate” system
European Higher Education Area

Since 2010, European Higher Education Area collaboration on higher education of 48 countries
- progressive structural reforms
- common framework
- shared tools

Objectives:
- increase student mobility
- increase staff mobility
- facilitate employability

http://www.ehea.info/
European Credit Transfer System (ECTS)

standard means for comparison of academic credits and mobility increase

1 ECTS credit = 25 to 30 working hours
(personal and training)

1 year = 2 semesters = 2 x 30 ECTS credits

Key of mobility

- **Grading**
  - A top 10% of the students
  - B 10% to 35%
  - C 35% to 65%
  - D 65% to 90%
  - E 90% to 100%
  - F Fail

http://www.ehea.info/
Bachelor Master Doctorate (BMD) system

Higher Education (after secondary School)

Bachelor
3 years
$3 \times 60 = 180$ ECTS

Master
2 years
$2 \times 60 = 120$ ECTS

Doctorate
3 years
French case

From 2003

2.7 Millions students in 2019


* 26% of students in technical training or other
French Master degrees

600,000 Master students in 2019

Master = 2 years = 4 semesters = 120 ECTS
(generally 1 semester of internship)

- industry-oriented Master
  (more application courses + internship in industry)

- general Master

- research-oriented Master
  (more scientific courses + internship in research Lab)

But any master should have a link with research Labs
University of Lille – general figures

Lille and suburbs more than 1.5 million inhabitants
at the crossroad of France / Belgium / UK

University of Lille in 2020
- 72,000 students (12% foreign students)
- 6,700 staff
- 66 research Labs

https://www.univ-lille.fr/home/
University of Lille – education organization

Multidisciplinary university:
• Social & human sciences
• Economy & laws
• Health & medicine
• Sciences & technologies
• etc.

72,000 students
14 faculties

8,000 students
9 departments

“Electrical Engineering & Automation” department

1 Bachelor + 3 Masters

Master « Automatic Control & Electrical Systems »

180 students
2. Master “Automatic Control & Electrical Systems” (ACES)

Our students will be actors of tomorrow’s world to contribute to the society challenges!
Master ACES & organization

Master = 4 semesters = 2 years = 120 ECTS

towards a progressive specialization
to train experts

From common semester S1
to a specialty in M2

http://master-ase.univ-lille1.fr/
Master ACES & research supports

Lab of Electrical Engineering & Power electronics
(design & control of innovative e-systems, 100 members)

Centre de Recherche en Informatique Signal Automatique de Lille
(computer sciences and automatic control, 300 members)

with their scientific networks, international collaborations and industrial partners

http://l2ep.univ-lille.fr/
https://www.cristal.univ-lille.fr/
Master ACES & options

Industry-oriented and research-oriented defined in M2 (second year)

- M2 Automation & robotics (general)
- M2 Smart Electric Vehicles (industry)
- M2 Electrical Grids (industry)
- M2 Sustainable Development (research)

in the philosophy of a progressive specialization and thanks to the research Lab’s partners
The projects at the core of the Master ACES

M1 year
- S1: supervised project (5 ECTS)
- S2: semi-supervised project (10 ECTS)
- S3: semi-autonomous project (15 ECTS)
- S4: autonomous project (20 ECTS)

M2 year

Towards professional skills

Academic, industrial and/or research projects

Student projects
Master ACES & engineering schools

Common M2 with A&M ParisTech, Centrale Lille and Polytech’Lille (French Engineering Schools)

- attractiveness of high-level students
- sharing educational skills and teams

M1 in their Engineering Schools
M2 in Master ACES
Master ACES & international degrees

Double degrees with international universities with M2 mobility in France

- Robotic etc. (French)
- Electric Vehicles (French)
- Electric Grids (French)
- Sust. Develop. (English)

* since 2015: Argentina, Algeria, Brazil, China, Colombia, Germany, Greece, Iran, Italy, Jamaica, Kampuchea, Kazakhstan, Mauritius, Morocco, Pakistan, Portugal, Romania, Russia, Serbia, Spain, Turkey, Tunisia, UK, Uzbekistan, Vietnam, etc.
Master ACES & inputs/outputs

Strong attractiveness and selection, high-level of employability

Industry: employability rate 98% (French indicator of employability)

12% in Doctorate

S4
Robotic etc. (French)

S3
Electric Vehicles (French)

S2
Automatic Control

M1 year

S1
Automatic control & Electrical Systems

M2 year

S4
Electric Grids (French)

S3
Sust. Develop. (English)

100 students

80 students

100 students

400 applications in 2020 for M2 (30 selected)

600 applications in 2020 for M1

Eng. School + double degrees

European ERASMUS

strong Bachelor from abroad

Strong Bachelor in France

strong Master from abroad

Master ACES, October 2020
Master ACES & attractiveness actions

1-month Summer School
50% on technical lectures
50% on culture and language

Scholarships from French embassy

Industrial seminars from Peugeot and Valeo companies

Next edition July 2021
(face-to-face + on-line)

Driving test of the L2EP electric vehicle

http://aces2018.cue-lillenorddefrance.fr/
Master ACES & attractiveness actions

Annual Energetic Macroscopic Representation international summer school
• since 2016, joint organization with a partner university
• odd year in Lille / even year abroad (Canada, China, Spain, Portugal, Vietnam, etc.)
• 3 days on this modelling tool with application to electrified vehicles and other
• more that 60 attendees in average
• 5 lectures on concepts, 16 lectures on applications
• 3 simulation sessions (EV, Wind Energy, PV panels)
• 1 practical session + 1 vehicle demonstration in France

Strong support of industry in France: Siemens, SNCF, Peugeot, Valeo, dSPACE, etc.

http://www.emrwebsite.org/
3. Master option “Smart Electric Vehicles” (M2)
• **Objective:**
  train engineers for the challenge of the development of more electrified, sustainable and autonomous vehicles

• **Developed skills:**
  interaction between Electrical Engineering, Mechanical Engineering and Control Science (involvement of 3 departments)

**Applications:**
• road vehicles (pure electric or hybrid cars/buses/trucks)
• guided transports (more efficient subways/tramways/trains)
M2 “Smart Electric Vehicles” & general frame

Internship
4 to 6 months
20 ECTS

1 semester of training
1 semester of internship

Promotion 2020-2021
21 students (3 from abroad)

Common M2 with Polytech’Lille

Future double degree with Sherbrooke University (Canada)

adaptation week

English
& Com.
5 ECTS

Vehicle & Mechanics
5 ECTS

Vehicle & Automatic
5 ECTS

Vehicle & Systemics
5 ECTS

Vehicle & Electricity
5 ECTS

project
4 months
(half-time)
15 ECTS
M2 “Smart Electric Vehicles” & industry

**Internship**
- 4 to 6 months
- 20 ECTS

**“Industry contract”**
- (project + Internship) in industry
- Individual contract
  - In 2020-2021: 2 students (10%)  

**“Industrial project”**
- Collaboration industry – research Lab
- A way to preselect student for internship
- Towards industrial PhDs
  - In 2020-2021: 3 industrial projects

**“Industrial internship”**
- 90% of the students

**English & Com.**
- 5 ECTS

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<thead>
<tr>
<th>Component</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Vehicle &amp; Mechanics</td>
<td>5 ECTS</td>
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**Project**
- 4 months (half-time)
- 15 ECTS
“Smart Electric Vehicles” & research

Internship
4 to 6 months
20 ECTS

“Mater thesis”
• (project + Internship) in research Lab in 2020-2021: 1 students (5%)

“academic project”
• with a research Lab
• 2 students in the project
• on hot industrial topics
• often valuable experiences

“Research Lab internship”
• 10% of the students

First research experiences are also appreciated by industry
M2 “Smart Electric Vehicles” & schedule

- **Unit 1:** Adaptation week
- **Unit 2:** Teaching units
- **Unit 3:** Project
- **Unit 4:** Teaching units

- **Sept.**
  - Unit 1: Adaptation week
- **Oct.**
  - Unit 1: Teaching units
  - Unit 2: Project
- **Nov.**
  - Unit 3: Teaching units
- **Dec.**
  - Unit 4: Teaching units

- **Janv.**
  - Unit 4: Teaching units

- **Feb.**

- **2 weeks per month in industry**
  - for “industrial contract”

- **2 weeks per month in research Lab**
  - for “Master thesis”

- **2 weeks of training**
  - 2 weeks of project

- **1 technical unit = 1 month**
  - 2 weeks of lectures
  - Examination at the end of month

- open to industry to train engineers on a specific topic during 1 month
M2 “Smart Electric Vehicles” & technical units

- **Vehicle & Mechanics**
  - 5 ECTS

- **Vehicle & Electricity**
  - 5 ECTS

- **Vehicle & Automatic**
  - 5 ECTS

- **Vehicle & Systemics**
  - 5 ECTS

**Transversal unit**
- Zoom on different parts

**Disciplinary units**
- Zoom on actual and future batteries
- Zoom on advanced control laws
- Zoom on innovative transmissions

*Example of an EV*

*Matlab-Simulink ©*

*EMR formalism*
M2 “Smart Electric Vehicles” & seminars

Seminars of international or industrial speakers

- **Prof. C.C. Chan** (Univ. Hong-Kong, China)
- Prof. L. Boulon (IRH, Canada)
- Dr. R. Trigui (IFSTTAR, MEGEVH)
- Prof. P. Barrade (HE Sion, Switzerland)
- **Prof. Y. Li** (Tsinghua Univ. China)
- Prof. T. Hofman (TU/e, Netherlands)
- Prof. E. Hittinger (RIT, USA)
- Prof. J. Trovao (Univ. Sherbrooke, Canada)
- Prof. K. Li (Univ. Notthingham, UK)
- etc.

- Dr. A. Bassel (**Ferrari** F1, Italie)
- Dr. T. Letrouvé (**SNCF**, MEGEVH)
- S. Hibon (**Alstom**, MEGEVH)
- Dr. C. Mayet (**Siemens Mobility**)
- Dr. Y. Cheng (**PSA**, MEGEVH)
- C. Jivan (**Valeo**)
- C. Brocart (**MEL**)
- etc.

- common to other M2 if common topic
- 1-page abstract for each seminar

Seminars of Prof. K. Li

Seminars of Prof. C.C. Chan

Seminar of Prof. C.C. Chan
Highly motivated Master students from 8 nationalities
Conclusion
A virtuous circle thanks to research Labs!

Master ACES

Research Labs

International partners

and many others

industrial partners

and many others
Thanks for your attention!

Any questions/comments:
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our students,
our best ambassadors!