Higher Education in acoustics in the framework of the LMD system, from College to PhD. The case of the University of Maine (Le Mans)

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The LMD system

Bachelor's (Licence)  Master's (Master)  PhD (Doctorat)

with the help of

Michel Combarnous (University Bordeaux 1, President of the French Mechanical Association - AFM),
and Michel Lebouché (Head of the Scientific, Technic and Pedagogic Mission - French Ministry of Education)

ECTS: European Credit Transfer System

A student obtains the "credits" of a lecture, only if he obtains a good enough ECTS mark.

ECTS GRADING SCALE

<table>
<thead>
<tr>
<th>ECTS mark</th>
<th>Percentage of successful students normally achieving the grade</th>
<th>Comment</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10 % EXCELLENT</td>
<td>Outstanding performance with only minor errors</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>25 % VERY GOOD</td>
<td>Above the average standard but with some errors</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>30 % GOOD</td>
<td>Generally sound work with a number of notable errors</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>25 % SATISFACTORY</td>
<td>Fair but with significant shortcomings</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>10 % SUFFICIENT</td>
<td>Performance meets the minimum criteria</td>
<td></td>
</tr>
<tr>
<td>FX</td>
<td>FAIL</td>
<td>Some more work required before the credit can be awarded</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>FAIL</td>
<td>Considerable further work is required</td>
<td></td>
</tr>
</tbody>
</table>

http://europa.eu.int/comm/education/programmes/socrates/ects_en.html
THE LMD SYSTEM: TRANSITIONAL PHASES

- First setting-up in October 2003 (some precursors shortly before), gradual (year after year) or massive (for instance Univ. Bordeaux 1), in the framework of four-year contracts.
- Provisionally, the former diploma DEUG (1st and 2nd years of the Bachelor's degree), and "Maîtrises" (1st year of the Master's degree) are maintained.
- Medicine: for the moment, nothing has changed.
- The institutions supervised by other ministries (architecture, agriculture, industry) are involved in the reform.

THE VOCABULARY

- Licence or Master XXX,
- Mention YYY,
- specialisation, career ZZZ (spécialité, parcours in french)

The vocabulary can vary from one university to another one

Examples of a small university (Univ. du Maine, Le Mans) and of a big university (Paris VI)

SMALL UNIVERSITY: Université du Maine (1/2)

- 5 domains including the Sciences and Technologies domain
- 5 Masters, including the Sciences and Technologies Master which includes 7 mentions

SMALL UNIVERSITY: Université du Maine (2/2)

- Research (MR) or vocational (MP) specialization

- 1st year Master S&T "Mechanical and Acoustic Engineering ("Ingénierie Mécanique et Acoustique")

- PhD
  - MP Transportation Acoustics (ADT)
  - MR Acoustics
  - MR Materials and Acoustics (MATAC)
Masters in France: a first assessment

- End of May 2005: more than 80% of the "masters" proposed by the institutions has been evaluated (four-year contracts, the remaining concerns Paris and the surrounding departments) (a final assessment at the end of September)

- Except Paris and the surrounding departments,
  - 1751 mentions (1020 different titles)
  - Including 5841 specializations (3083 vocational, 2758 research) are accredited (by the Ministry of Education)

- The specializations, in particular "research", are often involved in several institutions, via co-habilitations.

Distribution of MASTERS' mentions between the different fields (linked to the scientific boards of the French Ministry of Education)

- Mathematics (4.6%) 80
- Physics (3.5%) 62
- Sciences of Earth, Universe and Space (3.6%) 63
- Chemistry (4.3%) 75
- Biology, Medicine, Health (8%) 140 (except strictly medical studies)
- Human sciences, Humanities (25.2%) 441
- Social sciences (30%) 525
- Engineering sciences (6.5%) 114
- Information and communication technology sciences (9.8%) 172
- Agronomical and ecological sciences (4.5%) 79

THE PhD DEGREE COURSE

- The PhD degree is prepared over a 3-year period following a research master (nothing has changed).

- The laboratories and "doctoral groups" are put together in doctoral schools (écoles doctorales in French). Size: 50 PhD/year for instance.

- These doctoral schools propose some lectures to 1st-year and 2nd-year PhD-students. They must pass 4 lectures (about 25 hours each). They can validate lectures in other doctoral schools.
The teaching of acoustics at the University of Maine (Le Mans - France)
Synoptic view of acoustic skills: the four fields of activity, the engineering domains, the specialised aeras (from outside to center). Adapted from R.B. Lindsay, J. Acoust. Soc. Am., 36, 1964, by Michel Bruneau, Pr., and Catherine Potel, Pr., French Acoustical Society.
EDUCATION IN ACOUSTICS & MECHANICS

Relying on the Acoustic Laboratory of the University of Maine (LAUM), associated to the CNRS

- 28 teachers and researchers and 8 researchers
- 7 administrative and technical staff
- 22 PhD students

http://www.univ-lemans.fr/progens/deaacous/mecaacou/
Scientific and Technical University Diploma (DEUST)
Vibrations Acoustics Signal processing (VAS)
at the University of Maine

DEUST
Vibrations Acoustics Signal

**Aims**
- *Short courses*, with a vocational purpose
- Training of *higher technicians* in acoustic and vibratory measurements.
- *Unique* training *in France*, created in 1990

DEUST
Vibrations Acoustics Signal

**Work fields**
- **Transportation**
  - cars: manufacturers (PSA, Renault) and car parts manufacturers
  - railway, subway (SNCF, RATP)
  - maritime
  - aircraft, aerospace
- **Acoustic engineering**: noise and annoyance
- **Building acoustics**: house, flat, public and manufacturer offices
- **Electro-acoustics**: loudspeaker, baffle
- **Sonorisation**: public and manufacturer offices, auditoria
- **Consultancy (companies)**: building and room acoustics, environmental acoustics, vibro-acoustics
- **Medical acoustics, submarine acoustics, geodynamics** ...

DEUST
Vibrations Acoustics Signal

**Missions of DEUST VAS' level**

**Several examples:**
- **Manufacturers**
  - setting-up of acoustic and vibratory experimental set-up
  - measurements
  - data processing
  - technical writing
- **Consultancy companies**
  - environmental intervention
  - computing simulations
  - noise measurements in factories or outside (environment)
  - implementation of solutions
  - measurement in order to check.
Contents of the training courses

- **general training (450 h)**
  (Physics, Electronics, Mathematics, Computing, Scientific and technical english, writing and oral expression)

- **vocational training courses for an acoustician (670 h)**
  (Mechanics, Vibrations, Thermodynamics, Physical acoustics, Electro-acoustics, Signal processing, Instrumentation, Sound perception)

- **vocational training courses** taught by professional engineers (100 h)
  Two optional subjects: Noise and vibrations, Speech and manufactured Sonorisation

- **projects and training periods**
  - 13-weeks training period in a company, in France or abroad (2nd year)
  - 32 hours/year of tutorials projects

Continuation of studies

- General Bachelor's degree: physics, mechanics, electronics
- Vocational Licence (environment ...)
- Scientific and Technical Master (audiovisual ...)
- Engineering schools (sensor, vibrations, environment ...)

How to apply?

- Having a Scientific or Technical *Baccalaureat*
- Enrolment subject to an *interview*
- Possible *direct access in 2nd year* after validation studies, subject to an application file and an interview (DUT, BTS, DEUG MIAS, SM, ...)
- Application file can be requested *from 15th June*

Vocational Licence of mechanics, speciality "Acoustic and Vibratory Engineering"

Why?
- Since 1990, Deust Vibrations-Acoustics-Signal VAS
- Follows the technical and technological evolution of the trades in acoustics
- Answers the diversification of the industrial demands for modal analysis, propagation in materials, flow, building acoustics and so on.

Work fields
- Car area (measurements, result analysis, wide skill on the whole experimental set-up) and more generally transportation area
- Consultancy (building or room acoustics, modal analysis, ….)
- Else… (electroacoustics, "sonorisation", ….)

Who can apply?
- Preliminary degrees
- Technical University Diploma
- DEUST VAS
- Continuous training, (in-house) training
Contents of the training courses

- UE1: differentiated careers
  - 90 h

- UE2: tutorial projects
  - 135 h

- UE3: general knowledge
  - 100 h

- UE4: vibration and acoustic measurements and modelisations
  - 220 h

T1: acoustics and materials
  - 135 h

T2: modal analysis
  - 90 h

T3: acoustics and flow
  - 70 h

T4: building acoustics
  - 50 h

UE: Teaching Unit (Unité d'Enseignement in French)

* : per student

+ 16 week-training period

Tutorial projects

- Three or four students per group
- Different university and/or professional origins
- Beginners' course in virtual instrumentation and/or MATLAB software
- Learning to manage a project
- Proposed by the education staff, with links to the industrial demands

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Practical classes (1/4)

- Materials and acoustics
  - Ultrasonic dispersion and attenuation in a porous ceramics
  - Measure of the absorption of porous materials
  - Tortuosity and viscous characteristic length

Practical classes (2/4)

- Modal analysis
  - Modal analysis of a plate
  - Modal analysis of a beam

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Practical classes (2/4)

- Modal analysis
  - Modal analysis of a plate
  - Modal analysis of a beam
Practical classes (3/4)

- Acoustics and flow
  - Subsonic wind tunnel
  - Reflection and transmission coefficients
  - Exhaust

Practical classes (4/4)

- Environmental and building acoustics
  - Wall transparency measurement
  - Omnidirectional source and reverberant room

Vocational Licence for Acoustic and Vibratory Engineering

**How to apply?**

- Application file can be requested by regular mail or on Internet
- Dead-line for returning application file: 15th April
- Answer: Beginning of May


Vocational Licence for Acoustic and Vibratory Engineering

**Address**

Université du Maine
Faculté des Sciences et Techniques, Laboratoire d’Acoustique
M. Jean-Pierre DALMONT
Président du jury de la Licence Professionnelle de Mécanique, "spécialité Ingénierie Acoustique et Vibratoire"
Avenue Olivier Messiaen
72 085 LE MANS Cedex 9 - France

Master Sciences and Technologies, mention "Mechanical and Acoustic Engineering"

Acoustic Research Master

- Theoretical training courses as a preparation degree for research
- Possibility to go on PhD
- Possibility to find an engineer/research job in a company

Position of former Acoustic PhD students 1997-2002

Acoustic Research Master

Relying on the Acoustic Laboratory of the University of Maine (LAUM), associated to the CNRS

- 28 teachers and researchers and 8 researchers
- 7 administrative and technical staff
- 22 PhD students

NUMBER OF PhD THESIS DEFENDED AT SCIENCES AND TECHNICS UNIVERSITY DEPARTMENT (UFR) AND AT ACOUSTIC LABORATORY (LAUM) (LAST 10 YEARS)

<table>
<thead>
<tr>
<th>Year</th>
<th>UFR-Sciences</th>
<th>LAUM</th>
</tr>
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<tbody>
<tr>
<td>1995</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>1996</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>1997</td>
<td>14</td>
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<tr>
<td>2004</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>2005</td>
<td>28</td>
<td>28</td>
</tr>
</tbody>
</table>

Total amount (11 years) 285

99 = 34.7 %
Vocational Specialisation "Transportation Acoustics" of Master's degree Sciences and Technologies, mention Mechanical and Acoustic Engineering

INITIAL TRAINING CONTINUOUS TRAINING

NOISE TECHNOLOGIES AND HUMAN SCIENCES
IN ORDER TO TRAIN SPECIALISTS CAPABLE OF DIALOGUING WITH ALL THE PARTICIPANTS OF TRANSPORTATION ACOUSTICS

Partnership with:

http://www.univ-lemans.fr/progens/deaacous/master_MP_ADT.htm

THE DIFFERENT PARTICIPANTS TO TRANSPORTATION ACOUSTICS

- Norms, attestations
- Data basis, classification
- Reglementation, ratification
- Appeal, jurisdiction

Manufacturers, motorist

Constructors

Exploiting entreprises

Management network firms

Network building societies

Society

The individual - consumer
psycho-acoustics

The individual - worker
ergonomics

MATERIALS AND ACOUSTICS RESEARCH

Vocational Master "Transportation Acoustics"

- Experimental methods for mechanics and signal processing
- Mechanical behavior of composite materials
- Damage and break of materials
- Acoustics of poro-elastic materials
- Vibrations-Vibroacoustics
- Propagation solid media, Non Destructive Testing, sensors and measurement
- Numerical methods
- Rheology of polymers
- Bibliographic seminars
- Training period

Materials and Acoustics Research
Master (MATAC)

- Professional partnerships:
  - Normets, CSTB

- September to December
  - pre-required courses: acoustics, mathematics, signal processing

- October - December: Fundamentals courses and professional seminars
  - acoustics, vibrations, vibro-acoustics, signal processing,
  - numerical methods, physio-acoustics
  - Experimental and numerical practical classes in acoustics
  - Law courses (Law department, University of Maine)

- January - beginning of February
  - 1 week at CSTB - Grenoble
  - 2 weeks at INRETS - Bron
  - 1 week at LCPC - Nantes

- Mid-February: 1 week in the suburbs of Paris (MATE, ADP, ASFA, DGAC, …) depending of
- End of February: Case study

- March - July: training period
- September: report and examination (viva voce); board examination
Master's degree Mechanical and Acoustic Engineering

- Registrar's office (Sciences and Technics department of University): 33 - 2 43 83 32 06 / 07
- Université du Maine, Laboratoire d’Acoustique de l'Université du Maine (LAUM), UMR CNRS 6613, Avenue Olivier Messiaen, 72 085 Cedex 9
- In charge of the whole master: Claude Depollier
- Coordinatrice: Catherine Potel
- First year: Olivier Richoux
- Second year: research specialisation "acoustics": Claude Depollier
- research specialisation "material and acoustics": Rachid El Guerjouma
- vocational specialisation "transportation acoustics": Catherine Potel
- e-mail: first name.surname@univ-lemans.fr ; Tel: 33-2 43 83 36 17 ; Fax: 33-2 43 83 35 20

Web site: http://www.univ-lemans.fr/progens/deaacus/

ACOUSTIC TRAINING IN FRANCE, BACHELOR'S DEGREE

LP : vocational licence

LP : option licence

MP : vocational master

MR : research master

Le Mans
MR, MP, option Engineer vibrations, signal, materials, transportation, NDT

Brest
option Engineer submarine acoustics

Tours
MR, MP medical imaging

Poitiers
MR, option Engineer aerodynamics, aeroacoustics

La Rochelle
IUP Civil engineering

Bordeaux
MR, MP ultrasounds, NDT, architecture

Toulouse
Engineer, IUP acoustics CNAM, aeroacoustics, audiovisual

Marseille
MR vibrations, signal, ultrasounds, ...

Grenoble
MP ultrasounds

Lyon
MR Engineering aeroacoustics civil engineering

Nancy
MR wood

Compiegne
MR (option), Engineer vibrations, coupling, ultrasounds

Paris, Cergy
MR, MP Engineer ultrasounds, civil engineering, ...

Anzouline
LP

Bordeaux
option licence

Le Havre MR, electronic, ultrasounds, imaging

Lille, Valenciennes
MR, option Engineer electronics, ultrasound, imaging

Compiègne
MR (option), Engineer vibrations, coupling, ultrasounds

Paris, Cergy
MR, MP, Engineer ultrasounds, civil engineering, ...

Nancy
MR wood

Lyon
MR Engineering aeroacoustics civil engineering

Grenoble
MP ultrasounds

Le Mans
DEUST, LP, option licence acoustics, vibrations, signal, ultrasounds

Paris, Cergy
DEST (CNAM), DUT hearing aid, civil engineering

St-Etienne
school courses combined with work experience acoustics, vibrations