NON DESTRUCTIVE Testing and Evaluation Materials & Structures

TRAINING CATALOG

Processes Reliability & Safety
Welcome to ECND Academy ....................................................... 4
Study at Le Mans Université .................................................... 5
Short courses to develop your NDT skills ................................. 7

Getting basic training in NDT:
• Start training now ............................................................... 8
• NDT&E Assistant ............................................................... 10
• NDT&E Technician ........................................................... 11
• NDT&E Higher Technical Diploma in Instrumentation Physics 12
• NDT&E Senior Technician ................................................. 13
• Master’s Degree in Engineering Acoustics
  Vibrations, Acoustics, Sensors .......................................... 14
• Master’s Degree in Acoustic Research .................................. 15
• Master’s Degree in Mechanics
  Mechanical Modelling and Vibrations ............................... 16
• Master’s Degree in Applied Physics and Physical Engineering 17
• PhD in the field of NDT&E .................................................. 18

International outreach ............................................................ 19

A SCHOOL-WORKSHOP
an international reference centre
for Non Destructive Testing
and Evaluation Training
Le Mans Université and its partners promoted the creation of ECND Academy - a workshop school in the field of Non Destructive Testing and Evaluation - and an international reference centre for the development of partnerships for training and employment with a view to consolidate an industrial sector of excellence.

ECND Academy strives to maintain industrial competitiveness at national and international levels.

Training future talents in new technologies is an essential role. ECND Academy’s vision fully embraces the technological challenges that companies must face in the industrial sector. ECND Academy wishes to articulate a strategy of skills development in action. Innovative pedagogy and technological innovation are at the core of its methods.

ECND Academy wants to mark an important stage in the cooperation between public bodies and services, professional organisations, and industrial and training stakeholders with a common objective to developing a unique and ambitious teaching tool.

ECND Academy aims to create a new training offer adapted to industrial expectations and to inspire a dynamic in which job training and qualifications are clearly anticipated to benefit employment and competitiveness for businesses.

The objective being to draw on NDT&E research activities to create new training programs. Indeed, it is no longer possible to segregate basic training, continuing education and research if we want to favour employment.

With its 3 faculties, 2 Technological Institutes (IUT) and Engineering School (ENSIM), Le Mans Université offers courses and internationally recognised expert research in the field of Sciences and Technology but also in Humanities, Languages, Law, Economy, Management and Social Sciences. There are 15 Joint Research Units (UMR), 6 of these being associated with the CNRS.

Le Mans Université pursues its mission of lifelong learning by welcoming students in basic education as well as individuals returning to education or in vocational training.

Le Mans Université created in 1977 and located 200kms West of Paris, Le Mans Université is a multidisciplinary establishment with 11,000 students on two campuses: Le Mans and Laval.

The university offers remarkable conditions that contribute to our students well-being and success:

- an extensive course offering
- innovative training methods and formats
- individual coaching and support
- a thriving student life with special interest, cultural or sports groups
- modern and operational equipment
Developing your NDT skills

[ Short courses ]

Getting basic training in NDT&E
- Basic scientific tools and instrumentation
- Materials and structures damage evolution
- Inspection Instruction
- Quality control and metrology in business settings
- NDT&E methods scope of application and limits

Using traditional NDT methods
- Ultrasounds - UT
- Radiography - RT
- Penetrant Testing - PT
- Magnetic Particle Testing - MT
- Eddy Currents Testing - ET
- Thermography - TT
- Shearography - ST

Monitoring ongoing technology evolution and adapt to new NDT methods
- Opto-acoustics
- TOFD - Time of Flight Diffraction
- Airborne ultrasounds
- Radiography - ionising radiation
- Nonlinear acoustics
- Sensors
- Guided waves
- EMATS - ElectroMagnetic Acoustic Transducer
- Signal processing for acoustic emissions
### Academic qualifications in NDT&E

<table>
<thead>
<tr>
<th>JOBS</th>
<th>SKILLS</th>
<th>LEVEL</th>
<th>QUALIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDT&amp;E Assistant</td>
<td>• Participate in the preparation of inspections</td>
<td>Secondary Education/ High School diploma</td>
<td>Special mention: NDT Assistant</td>
</tr>
<tr>
<td></td>
<td>• Identify non-compliances with standards and regulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Set up and verify the operation of control apparatus</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Ensure the maintenance of control apparatus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NDT&amp;E Technician</td>
<td>• Implement a measurement chain</td>
<td>2-year University Diploma</td>
<td>NDT Technician Technical Diploma</td>
</tr>
<tr>
<td>Instrumentation Physics Technician</td>
<td>• Control the integrity of the manufacturing process</td>
<td></td>
<td>Instrumentation Physics Higher Technical Diploma</td>
</tr>
<tr>
<td></td>
<td>• Take appropriate corrective action</td>
<td></td>
<td>Higher Technical Diploma</td>
</tr>
<tr>
<td></td>
<td>• Set up equipment and carry out inspections</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Interpret and evaluate test results</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Assess inspected items for agreement or refusal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NDT&amp;E Senior Technician</td>
<td>• Apply frequently used NDT techniques in industry: ultrasounds, radiography, Eddy Currents, thermography, etc...</td>
<td>3-year Bachelor’s Degree</td>
<td>NDT&amp;E Technical Degree</td>
</tr>
<tr>
<td></td>
<td>• Implement compliance tests on instrumentation and equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Identify non-compliances with standards and regulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Organise and manage NDT instrumentation for the purpose of manufacturing, maintenance or accreditation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NDT&amp;E Engineer</td>
<td>• Master NDT&amp;E methods used in industrial settings</td>
<td>5-year Master’s Degree</td>
<td>MEng Engineering Acoustics</td>
</tr>
<tr>
<td></td>
<td>• Perform tests and trials</td>
<td></td>
<td>MS Acoustics</td>
</tr>
<tr>
<td></td>
<td>• Carry out signal and image processing</td>
<td></td>
<td>MS Mechanics</td>
</tr>
<tr>
<td></td>
<td>• Analyse results and determine necessary adjustments to products and structures</td>
<td></td>
<td>MS Applied Physics and Optics</td>
</tr>
<tr>
<td></td>
<td>• Perform technical inspections</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Manage NDT&amp;E projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researcher</td>
<td>• Define and develop research projects in NDT&amp;E</td>
<td>8-year Doctorate</td>
<td>PhD</td>
</tr>
<tr>
<td></td>
<td>• Contribute to increase and disseminate new knowledge in the field of NDT&amp;E</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Transmit NDT&amp;E theories and know-how through research and teaching</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Preparation to COFRENQ, accreditation according to the certificate target level (1, 2 or 3)
The NDT&E Assistant prepares and organises tests during which products will be inspected without destruction. He watches over the formalisation of the necessary procedures and ensures that control apparatus is properly maintained (Magnetic Particle Testing, Radiography). He has to organise his control station and follow safety instructions. This special mention at the end of a secondary education vocational curriculum is geared towards employment.

**Apprenticeship**

**Public**  
Training is available to candidates aged 16 to 30 with an apprenticeship contract.

**Pre-requisites**  
Candidates must hold a Secondary Education/High School Diploma.

**Learning objectives**  
At the end of the course, students will be able to prepare and organise NDT tests in an industrial setting while following safety regulations.

**Content**  
Duration : 12 months

**Academic courses** : French, Maths

**Vocational courses** : Metalwork, NDT Methods (Ultrasounds, Eddy Current, Radiography, Magnetic Particle, Penetrant Testing), practical applications of NDT testing.

**Teaching methods**  
Block-release training to promote the application of theoretical principles in a real-life setting. The candidates will benefit from individual guidance and training during the cursus.

**Assessment methods**  
Written and practical tests based on the COFREND (Confédération Française des Essais Non Destructifs) Level 1 certification reference framework.

**Training staff**  
Secondary Education/High School teachers and NDT experts.

**Contact**  
ecnd.academy@univ-lemans.fr

---

**TARGETED SKILLS**

- Participate in the preparation of inspections
- Identify non-compliances with standards and regulations
- Set up and verify the operation of control apparatus
- Ensure the maintenance of control apparatus

---

**Fees**  
Full details available on Le Mans Université website : http://www.univ-lemans.fr

---

**NDT Technical Diploma**  
2-year University Diploma

**Block-release training**

**Public**  
Training is available to all candidates in basic or continuing education.

**Pre-requisites**  
Candidates must hold a Secondary Education/High School Diploma in Sciences or Technology, preferably within the fields of Mechanics, Metalwork, Metrology and Physics Instrumentation. Candidates with a minimum of 12 months’ work experience in an industrial setting will also be considered.

**Assessment methods**  
Written and practical tests based on the ongoing assessment.

**Learning objectives**  
At the end of the training, students will be able to:
- Determine the scope of application and the limits of frequently used NDT techniques in industry: penetrant testing, radiography X, Magnetic Particle Testing, thermography (infra-red, Eddy Currents, ultrasounds, etc.)
- Control the integrity of the manufacturing process: spare parts, sub-assemblies, assemblies
- Follow and monitor quality control with regards to regulations, processes and instructions
- Identify instances of non-compliance and variance with standards and take appropriate corrective action
- Set up equipment and carry out inspections
- Interpret and evaluate test results to assess inspected items for agreement or refusal
- Draw up compliance testing as well as quality control and tracking documents

**Contact**  
ecnd.academy@univ-lemans.fr

---

**TARGETED SKILLS**

- Implement a measurement chain
- Control the integrity of the manufacturing process
- Take appropriate corrective action
- Set up equipment and carry out inspections
- Interpret and evaluate test results
- Assess inspected items for agreement or refusal

---

**Fees**  
Full details available on Le Mans Université website : http://www.univ-lemans.fr

---

For further information, complete the contact form on ecnd-academy.com website.
Instrumentation Physics Technician

2-year Higher Technical Diploma

The Instrumentation Physics Higher Technical Diploma is a 2-year university qualification aiming to train versatile senior technicians who can make measurements and interpret experimental data. Their body of knowledge stems from diverse theoretical fields: physics, chemistry, materials science, electronics, and computer science. Graduates find employment in various sectors of industry, research and services.

Public
- Training is available to all candidates in basic or continuing education, classic or block-release courses.

Pre-requisites
- Candidates must hold a Secondary Education/High School Diploma in Sciences, Technology or Engineering or a relevant diploma granting access to higher education.

Learning objectives
- The training prepares senior technicians in the service fields of quality, metrology, instrumentation, tests, and in industrial manufacturing sectors (automotive, aeronautics, electronics, materials, environments, optics).

Content
- 1800 hours of training (360 hours of lectures, 668 hours of lab work) and 300 hours of project-based work.
- The training takes place over 4 academic semesters (2 years) and is based on 5 main subject areas:
  - Physics: understanding of phenomena in relation to sensors and being able to interpret test results.
  - Chemistry: chemical analysis and environmental analysis: understanding and mastering chemical analysis techniques and being able to interpret test results.
  - Materials science: understanding the specific properties of materials and mastering the main techniques of materials characterization and control. Additional NDT module in Year 2: Thermography, Magnetic Particle Testing and Ultrasonic Testing.
  - Metrology: understanding the fundamental concepts of physics measurements.
  - Instrumentation: understanding the diverse subject areas necessary to design and implement a measurement chain.

Assessment methods
- Written and practical tests on the basis of an ongoing assessment.

This Higher Education Technical Diploma leads to 120 ECTS (European Credit Transfer System) or 30 ECTS per validated semester.

Training staff
- Academic staff and NDT experts.

Contact
- iut-mp@univ-lemans.fr

Fees
- Full details available on Le Mans Université website: http://www.univ-lemans.fr

For further information, complete the contact form on ecnd-academy.com website.

NTD&E Senior Technician

Year 3 of Technical Degree

This course aims to train NDT&E technicians at senior level who can implement most common NDT methods in industry and services. Business sectors where product and structures quality, integrity or maintenance is paramount have a vested interest in NDT&E, for instance: aeronautics, shipbuilding, metallurgy, automotive, railways, nuclear, civil engineering, building, R&D and consultants.

Public
- Training is available to all candidates in basic or continuing education, classic or block-release courses (work/study or apprenticeship contract).

Pre-requisites
- Candidates must hold a Technical Diploma, Higher Technical Diploma or equivalent qualification to apply for this course. An accreditation scheme is also available for those who can demonstrate that all or part of the course contents have been mastered through previous work experience.

Learning objectives
- At the end of the course, students will be able to:
  - Take COFREND (Confédération Française des Essais Non Destructifs) Level 2 NDT&E examinations
  - Refer to the fundamental concepts in materials structure and properties (microstructure, assembly)
  - Refer to the fundamental concepts of physics and mechanics phenomena occurring in NDT&E
  - Apply the most frequently used NDT methods in industry
  - Draw on a general scientific and technological culture to tackle new work situations and develop the expertise to evolve within their sector of industry

Assessment methods
- Written and practical tests on the basis of an ongoing assessment.
- Integration of the COFREND (Confédération Française des Essais Non Destructifs) Level 2 certification reference framework.

Training staff
- Academic staff and NDT experts.

Contact
- Faculty of Science and Technology (admissions)
  - Tel.: +33 2 43 83 32 07/32 05
  - sco-sciences@univ-lemans.fr

Fees
- Full details available on Le Mans Université website: http://www.univ-lemans.fr

For further information, complete the contact form on ecnd-academy.com website.
Engineer in Vibrations, Acoustics, Sensors

[ MEng Engineering Acoustics ]
5-year Master’s Degree

Le Mans Université Post-Graduate Engineering School (ENSIM) trains future engineers for 5 years in two fields (vibrations, acoustics and sensors and computer science) with an integrated preparatory cycle. The ENSIM aims to develop complementary skills and careers through these two specialisations in the same school. Professional skills studied encompass the scope of business data processing: sensors, digital modelling, instrumentation, embedded systems, human-machine interface. The programme is open to candidates in continuing education.

Teaching methods
Engineering students are encouraged to develop collaborative skills in a context where practical work, project-based work and cross-disciplinary subjects (communication, business culture) benefit all. On-the-job training periods are organised to enable students to gain professional experience:
- A 6 - 6 week work placement as a technician or senior technician
- A 6 months’ end-of-year internship, in France or abroad

Assessment methods
Students are granted a validation of a year’s study if both semesters are validated (30 ECTS for each semester). Individual modules are validated and the relevant ECTS granted if the weighted average of the assessments are equal or superior to 10/20.

Training staff
Academic staff and NDT experts.

Contact
ENSIM (admissions)
scolarite.ensim@univ-lemans.fr

[ MS Acoustics ]
5-year Master’s Degree

The Master of Acoustics provides a range of classes in the main fields of fundamental and applied acoustics: physical acoustics, non-linear and aero-acoustics, condensed matter acoustics, electro-acoustics, vibro-acoustics, musical and building acoustics, perception and psycho-acoustics, physio-acoustics, experimental methods in acoustics, digital acoustics, etc...

Public
Training is available to all candidates in basic or continuing education.

Pre-requisites
Year-1 admission: candidates must hold an Engineering or an Acoustics Bachelor’s Degree.
Year-2 admission: candidates must have completed Year-1 of a Master’s Degree in Acoustics programme or similar: mechanics, physics, electronics, applied mathematics or an Engineering Bachelor’s Degree in similar fields of study. An accreditation scheme is also available for those who can demonstrate that all of the Year-1 course contents have been mastered through previous work experience.

Selection of candidates will be made on the basis of their application and student record.

Learning objectives
Students will be trained in the general and specialist fields of acoustics with a view to work in the business sector (R&D) and within research organisations. During Year 1, they will learn the fundamentals of acoustics and will also be able to study specialist modules. Year 2 focuses on specialist teachings and includes an on-the-job period in a research lab or organisation, or in a business setting.

Content
Year 1: a single programme designed to provide general knowledge of acoustics as well as specific modules for the different specialist areas of acoustics.
Year 2: a common foundation programme: guided waves and modal approach, psychoacoustics, nonlinear acoustics, solids and fluids acoustics, signal processing, vibrations/ vibro-acoustics, experimental methods, digital methods in acoustics and vibrations.

Two specialisations with different modules:
- Fluids: porous materials and periodic media acoustic properties, aero-acoustics.
- Solids: opto-acoustics, ultrasound for NDT, digital methods for NDT (60 hours of NDT).

Teaching methods
Conceptual and practical learning during lectures, tutorials and lab work. On-the-job training period in Year 2 between February and July.

Assessment methods
Written and practical tests on the basis of an ongoing assessment. Students need to obtain the validation of 120 ECTS over the 2 years.

Training staff
Academic staff and NDT experts.

Contact
Faculty of Science and Technology (admissions): Tel. +33 2 43 83 32 07/32 06 sco-sciences@univ-lemans.fr

Fees
Full details available on Le Mans Université website: http://www.univ-lemans.fr

For further information, complete the contact form on ecnd-academy.com website.

14

For further information, complete the contact form on ecnd-academy.com website.

15
Mechanics modelling and vibrations

The Master of Mechanics with a specialisation in Mechanic modelling and vibrations is designed to train future research and development engineers. Graduates who are interested in pursuing their cursus may apply to be considered for a PhD thesis.

Public
Training is available to all candidates in basic or continuing education.

Pre-requisites
Candidates must hold a Bachelor’s Degree in a field relevant to the Master’s Degree (mechanics, physics, engineering, etc...). An accreditation scheme is also available for those who can demonstrate that all or part of the course contents have been mastered through previous work experience.

Learning objectives
This Master’s Degree prepares students to develop the following skills:

One of the main features of this Master Mechanics, Modeling in Mechanics and Vibrations (MMV), in this programme but many modules are shared with other Masters courses in the Science and Technology field and it is therefore possible to transfer to another course: for example, the Master of Acoustics, Electro-Acoustics, Physics and with the Post-Graduate Engineering Schools (ISMANS and ENSIM).

Teaching methods
Conceptual and practical learning during lectures, tutorials and lab work.

On-the-job training period in Year 2.

Assessment methods
Written and practical tests on the basis of an ongoing assessment.

Students need to obtain the validation of 120 ECTS over the 2 years.

Training staff
Academic staff and NDT experts.

Contact
Faculty of Science and Technology (admissions):
Tel. +33 2 43 83 32 07/32 06
sco-sciences@univ-lemans.fr
master.mecanique@univ-lemans.fr

Fees
Full details available on Le Mans Université website:

TARGETED SKILLS

• Master NDT&E methods used in industrial settings
• Perform tests and trials
• Analyse results and determine necessary adjustments to products and structures
• Perform technical inspections
• Manage NDT&E projects

For further information, complete the contact form on ecnd-academy.com website.

Applied Physics and Physical Engineering

[ MS Mechanics ]
5-year Master’s Degree

The two specialisations of the Master of Applied Physics and Physical Engineering draw on research expertise in the following fields:

• Functional Nanomaterials and Nanostructures (PNANO).
• Innovative optical methods applied to the study of materials (OAM).

Public
Training is available to all candidates in basic or continuing education.

Pre-requisites
Candidates must hold a Bachelor’s Degree in a field relevant to the Master’s Degree (physics, engineering, etc...). An accreditation scheme is also available for those who can demonstrate that all or part of the course contents have been mastered through previous work experience.

Learning objectives
This Master’s Degree prepares students to develop the following skills:

• Identify and develop data mining, collecting and analysis methods
• Present and explain scientific advances and research work
• Monitor and control the process and the progress of scientific experiments and observations
• Participate to the development and the tuning of new products with digital tools

Training staff
Academic staff and NDT experts.

Contact
ENSIM (admissions)
scolarite.ensim@univ-lemans.fr

Fees
Full details available on Le Mans Université website:

TARGETED SKILLS

• Master the NDT&E methods applied in an industrial environment
• Perform tests, analyses data and determine the product and procedure
• Analyze the choices and define technical orientation.
• Manage and co-ordinate NTD projects
• Lead technical expertise
• Carry out a technical expertise
• Coordinate and manage projects

For further information, complete the contact form on ecnd-academy.com website.
Regional post-graduate schools for doctoral studies have been re-organised in order to provide specific local orientations as well as programme homogeneity for students. The local doctoral school draws from the expertise of Le Mans Université research laboratories to provide transversal scientific projects and events, notably with a view to prepare students for professional integration.

Le Mans Université research teams welcome around 260 doctoral students every year. The legal duration of a French doctoral degree is 3 years for students being granted specific funding.

Doctoral schools and NDT

Le Mans Université doctoral training offer is provided in 10 different interregional locations of which 2 are directly linked to NDT:

- ED SPI - Engineering Sciences
- ED 2M - Matter, Molecules and Materials

Le Mans Doctoral School

In full coordination with the regional centre, Le Mans doctoral school:

- guarantees transversal campus-wide scientific events
- encourages close links between PhD students, their tutors and research units
- manages the coordination of the specific doctoral schools (ED) on site

It has an administrative centre and a consultative body composed of representatives of different schools, research units and doctoral students.

Missions

- Follow-up
- Transversal courses
- Doctoral contracts
- National and international support
- Event organisation

Contact

poledoctoral@univ-lemans.fr

TARGETED SKILLS

- Master NDT&E methods used in industrial settings
- Perform tests and trials
- Analyse results and determine necessary adjustments to products and structures
- Perform technical inspections
- Manage NDT&E projects

Fees

Full details available on Le Mans Université website:

For further information, complete the contact form on ecnd-academy.com website.
Non Destructive Testing and Evaluation
with financial support from the Program of Investments for the future