General description

Name of the course: Non destructive Testing in Mechanical Engineering
Department: Mechanical Engineering (EM)  
Strength of Materials and Structural Engineering (RMEE)
ECTS: 6 ETS
Degree: MASTER’S DEGREE IN RESEARCH IN MECHANICAL ENGINEERING
Level:
Language: English
Code: 295803
Type: Elective

Lecturers
Main teacher: Vega Perez Gracia (Strength of Materials and Structural Engineering) and Eva Martinez Gonzalez (Mechanical Engineering)

Others: -

General learning objectives of the course

The main objective of the course is providing to the professional engineer a global vision of the most common NDT methods in the industry and research, applied during the manufacturing or along the service life of the structures. At the end of the course the students will know different techniques, their applications and limits and they also will know how to handle several equipment and the interpretation of the obtained data.

Competences

<table>
<thead>
<tr>
<th>Specific competencies</th>
<th>To apply knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience and practice, with critical reasoning, to establish economically viable solutions to technical problems (CG1 and CG3). Conceptualize engineering models, apply innovative methods in the resolution of problems and adequate computer applications, for the design, simulation, optimization and control of processes and systems. Other specific competencies are: Requirements, restrictions and research objectives in the aforementioned topics and, calculation and experimental characterization tools suitable for each of the aforementioned topics</th>
</tr>
</thead>
</table>
| Generic competencies  | CG4 - Research, develop and innovate in the field of Mechanical Engineering.  
CG5 - Strategic planning and application of NDT tecnologies in construction, production, quality and environmental management systems. |

CG6 - Technically and economically manage projects, facilities, plants, companies and technology centers related to the design and manufacture of systems and elements of Mechanical Engineering

Credits: total hours of student work

<table>
<thead>
<tr>
<th>Directed learning</th>
<th>Large Group (G)</th>
<th>30</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium Group (M)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Small Group (S)</td>
<td>24</td>
<td>16%</td>
</tr>
<tr>
<td>Autonomous learning</td>
<td></td>
<td>96</td>
<td>64%</td>
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</table>

Modules

**Module 1: Introduction to NDT**

**Dedication:** 8 hours

- Large group: 2 hours
- Small group: 2 hours
- Autonomous learning: 6 hours

**Description**

- Origin
- Criteria in the NDT inspection
- Visual inspection

**Related activities ( )* **

- Theory classes

**Module 2: Thermography**

**Dedication:** 10 hours

- Large group: 2 hours
- Small group: 2 hours
- Autonomous learning: 6 hours

**Description**

- Physical principles
- Applications and limits
- Methodology
- Data interpretation

**Related activities ( )* **

- Theory classes
- Laboratory session 1: data acquisition and interpretation

**Module 3: Sonic and ultrasonic tests**

**Dedication:** 17 hours

- Large group: 3 hours
- Small group: 4 hours
- Autonomous learning: 10 hours

**Description**

- Physical principles
- Applications and limits
- Methodology
- Data interpretation

**Related activities ( )* **

- Theory classes
- Data interpretation and applications

**Module 4: Acoustic emission**

**Dedication:** 18 hours

- Large group: 4 hours
- Small group: 4 hours
### Module 5: Ground penetrating radar

<table>
<thead>
<tr>
<th>Related activities (*)</th>
<th>Theory classes</th>
</tr>
</thead>
</table>

**Dedication:** 18 hours
- Large group: 4 hours
- Small group: 4 hours
- Autonomous learning: 10 hours

### Module 6: Other techniques

<table>
<thead>
<tr>
<th>Related activities (*)</th>
<th>Theory classes</th>
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</thead>
</table>

**Dedication:** 12 hours
- Large group: 4 hours
- Small group: 4 hours
- Autonomous learning: 4 hours

### Module 7: Integrated studies

<table>
<thead>
<tr>
<th>Related activities (*)</th>
<th>Data acquisition and integrated interpretation</th>
</tr>
</thead>
</table>

**Dedication:** 20 hours
- Large group: 4 hours
- Small group: 6 hours
- Autonomous learning: 10 hours

### Activities

**Activity 1: Planning and field data acquisition (part of the final work)**

<table>
<thead>
<tr>
<th>Related activities (*)</th>
<th>Select a case study</th>
</tr>
</thead>
</table>

**Dedication:** 14 hours
- Large group: 2 hours
- Small group: 6 hours
- Autonomous learning: 12 hours

**Description**
- The students will select a case study and prepare a survey considering limits and advantages

**Related activities (*)**
- Select a case study
- Preparing a survey using combined methodologies
- Evaluate limits and advantages of each technique considering the problem and the case study
- Organizing the survey
- Data acquisition

**Activity 2: Data processing, analysis and interpretation (part of the final work)**

<table>
<thead>
<tr>
<th>Related activities (*)</th>
<th>Visualize field data</th>
</tr>
</thead>
</table>

**Dedication:** 16 hours
- Large group: 2 hours
- Small group: 6 hours
- Autonomous learning: 14 hours

**Description**
- The student will work with field data: visualization, processing, evaluation of boundary conditions, data analysis and combined interpretation

**Related activities (*)**
- Visualize field data
- Data processing (application of different filters, gains, 3D interpolation, …)
- Data interpretation considering separately the techniques

### Activity 3: Combined interpretation (part of the final work)

<table>
<thead>
<tr>
<th>Description</th>
<th>Dedication: 17 hours</th>
<th>Large group: 3 hours</th>
<th>Small group:</th>
<th>Autonomous learning: 14 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final data interpretation and report presentation</td>
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**Related activities (*)&**
- Description of limits, advantages and applications of each technique
- Combination of the different data interpretations, evaluating the differences between techniques and the possible complementary data.
- Final report
- Presentation of the final report and results

### Grading system (assessment)

- a) 2 partial exams with a weight of 15% each exam (30% the two exams)
- b) Laboratory sessions with a weight of 10% each session (30% the three sessions)
- c) Final project document (30%)
- d) Presentation of the final project (10%)

### Teaching methodology

- a) Theoretical session
- b) Laboratory sessions
- c) Project development

### References

**Basic**

**Complementary**
- Ground Penetrating Radar (2004) D.J. Daniels. Institute of Electrical Engineers