UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Escola Superior d'Enginyeries Industrial, Aeroespacial i Audiovisual de Terrassa

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

Specific competencies	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 competències are: Requirements, restrictions and research objectives in the aforementioned tòpics and, calculation and experimental characterization tools suitable for each of the aforementioned topics
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

		Dedication	
		Hours	%
Directed learning	Large Group (G)	30	20%
	Medium Group (M)	0	0%
	Small Group (S)	24	16%
Autonomous learning		96	64%

Modules

Module 1: Introduction to NDT	Dedication: 8 hours	Large group: 2 hours Small group: 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

		Autonomous learning: 10 hours
Description	– Physical principles – Applications and limits – Methodology – Data interpretation	
Related activities (*)	Theory classes Laboratory session 2: data acquisition and interpretation	

Module 5: Ground penetrating radar	Dedication: 18 hours	Large group: 4 hours Small group: 4 hours Autonomous learning: 10 hours
Description	– Physical principles – Applications and limits – Methodology – Data interpretation	
Related activities (*)	Theory classes Laboratory session 3: data acquisition and interpretation	

Module 6: Other techniques	Dedication: 12 hours	Large group: 4 hours Small group: 4 hours Autonomous learning: 4 hours
Description	Presentation of other techniques (e.g., vibration analysis, radiographic methods, liquid penetrant, optical methods, etc)	
Related activities (*)	Theory classes	

Module 7: Integrated studies	Dedication: 20 hours	Large group: 4 hours Small group: 6 hours Autonomous learning: 10 hours
Description	– Case study (final work)	
Related activities (*)	Data acquisition and integrated interpretation Analysis of complementary and supplementary techniques	

Activities

Activity 1: Planning and field data acquisition (part of the final work)	Dedication: 14 hours	Large group: 2 hours Small group: 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)	Dedication: 16 hours	Large group: 2 hours Small group: 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)	Dedication: 17 hours	Large group: 3 hours Small group: hours Autonomous learning: 14 hours
Description	Final data interpretation and report presentation	
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	Introduction to Nondestructive Testing: A Training Guide (2005) Paul E. Mix, Ed. Wiley Nondestructive Evaluation. Theory, Techniques, and Applications (2001) Peter J. Shull. CRC Press NDT data fusion (1997) X.E. Gros. Ed. John Wiley
Complementary	Ground Penetrating Radar (2004) D.J. Daniels. Institute of Electrical Engineers