Last update: 05-07-2018

340202 - FIPI-L7P02 - Reliability and Integrity of Industrial Products

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering

Teaching unit: 702 - CMEM - Department of Materials Science and Metallurgy

Academic year: 2018

Degree: BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 6 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: ENRIQUE MARTIN FUENTES

Others: ENRIC MARTIN - TEO MUNIATEGUI - SANTI MESTRES

Degree competences to which the subject contributes

Specific:

1. CE25. Knowledge and ability to apply material engineering.

Transversal:

2. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
4. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

Teaching methodology

Attending sessions of exposition of contents.
- Attending sessions of practical work (resolution of exercises).
- Attending sessions of practical work in working groups (practices of laboratory).

The professor will introduce the theoretic bases of the matter of the manufacturing processes in the sessions of exposition of contents.
The professor will guide the student in the understanding of the theoretic concepts in the sessions of resolution of exercises, likewise, the oral communication by means of the presentation will be worked up and resolution in public of the proposed problems.
The ability of work in team will develop in the sessions of laboratory.

In the out-class activities the professor supervises the student's work by means of the analysis of his evolution through the evaluation activity and the guided activities.

Learning objectives of the subject

1. Applying design criteria in order to ensure the mechanical reliability of products and systems.
2. Identifying the possible causes of failures of a component, in terms of the in service environment.
3. Offering solutions to avoid the failure of components.

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4. Analyzing and applying the methodology of application of nondestructive testing

Study load

Total learning time: 150h	Hours large group:	45h	30.00%
	Hours medium group:	0h	0.00%
	Hours small group:	15h	10.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

(ENG) 1. Nondestructive testing and quality management

Degree competences to which the content contributes:

Description:
(ENG) 1.1 Nondestructive Testing: Applicability. 1.2 Reliability. 1.3 Qualification and Certification

(ENG) 2. Penetrant testing

Degree competences to which the content contributes:

Description:
(ENG) 2.1 Penetrant Testing: Theory and principles. 2.2 Penetrant procedures. 2.3 Techniques and variables. 2.4 Advantages and limitations.

(ENG) 3. Magnetic particles testing

Degree competences to which the content contributes:

Description:
(ENG) 3.1 Magnetic particle testing: Theory and principles. 3.2 Equipment and techniques. 3.3 Variables. 3.4 Advantages and limitations.

(ENG) 4. Ultrasonic testing

Degree competences to which the content contributes:

Description:
(ENG) 4.1 Theory and principles: sound waves. 4.2 Ultrasonic Wave Propagation: Transmission and damping. 4.3 Equipment and techniques. 4.4 Variables. 4.5 Advantages and limitations.

(ENG) 5. Eddy currents testing

Degree competences to which the content contributes:

Description:
(ENG) 5.1. Eddy currents testing: Theory and principles (electromagnetic induction). 5.2 Impedance of samples. 5.3 Metallurgical variables. 5.4 Inspection techniques. 5.5 Advantages and limitations.

(ENG) 6. Radiographic Testing

Degree competences to which the content contributes:

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Description:
(ENG) 6.1 Electromagnetic spectrum. 6.2 Sources of emissions. 6.3 Damping of radiations. 6.4 Radiographic equipment and procedures. 6.5 Radiographic evaluation. 6.6 Biological Effects: safety considerations and health hazard

(ENG) 7.Other Nondestructive testing techniques

Degree competences to which the content contributes:

Description:
(ENG) 7.1 Thermal infrared testing. 7.2 Holography. 7.3 Barkhausen effect

(ENG) 8. Mechanical failures

Degree competences to which the content contributes:

Description:
(ENG) 8.1 Mechanical Failures: prevention and/or analysis?. 8.2 Failure modes: ductile fracture and brittle fracture

(ENG) 9. Fracture mechanics

Degree competences to which the content contributes:

Description:
(ENG) 9.1 Fracture mechanics: Fracture toughness 9.2 Metallurgical variables

(ENG) 10. Fatigue

Degree competences to which the content contributes:

Description:
(ENG) 11.1 Fatigue design: cyclic loadings. 11.2 Crack initiation and growth 11.3 Total-life approaches and damage-tolerant approaches.

(ENG) 11. Design for high temperature

Degree competences to which the content contributes:

Description:
(ENG) . 10.1 Creep: Alloys for high temperatures. 10.2 Thermal shock.

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(ENG) 12. Wear

Degree competences to which the content contributes:

Description:
(ENG) 12.1 Wear: wear mechanisms. 12.2 Effects of lubrication and metallurgical variables.

(ENG) 13. Materials degradation

Degree competences to which the content contributes:

Description:
(ENG) 13.1 Materials degradation: Electrochemical basis of corrosion. 13.2 Corrosion modes. Corrosion control. 13.3 Photochemical degradation

(ENG) 14. Failure analysis methodology: forensic engineering

Degree competences to which the content contributes:

Qualification system

The evaluation of the course will become according to the following indicators:

T, Theory: average mid-term exam 1 and mid-term exam 2.
P, Interventions in the classroom, in the case study. It is mandatory to evaluate, at least, 75% of the presentations
L, Practices of laboratory: Weighted average of the different programmed practices.

Final grade = 0,55T+0,20P+0,25L

The laboratory practices, the tests carried out via Campus Digital and the activities carried out in the classroom during the regular period of classes (problems and / or presentations of work) will not be re-evaluated.

The completion and presentation of the corresponding reports of at least 75% of the laboratory practices will be a necessary condition for the approval of the subject. It will also be a necessary condition to have participated in, at least, 75% of the presentations made in the classroom and to have made the evaluations of them.

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Bibliography

Basic:

Hertzberg, Richard W. Deformation and fracture mechanics of engineering materials. 5th ed. New York [etc.]: John Wiley & Sons, 2013. ISBN 978-0470527801.

Rösler, Joachim; Harders, H.; Bäker, M. Mechanical behaviour of engineering materials. Berlin ; New York: Springer, 2007. ISBN 9783540734468.

Mix, Paul E. Introduction to nondestructive testing : a training guide. 2nd ed. Hoboken: John Wiley & Sons, 2005. ISBN 9780471420293.

Noon, Randall. Forensic engineering investigation. Boca Raton: CRC Press, 2001. ISBN 0849309115.

Hellier, Charles. Handbook of nondestructive evaluation. New York , Madrid [etc.]: McGraw-Hill, 2001. ISBN 9780070281219.

Ensayos no destructivos [Recurs electrònic]. Madrid: AENOR, 2010. ISBN 9788481437126.

Complementary:

ASM handbook. Vol. 17, Nondestructive evaluation and quality control. Materials Park, Ohio: ASM International, 2005. ISBN 0871700239.

ASM handbook. Vol. 11, Failure analysis and prevention. Materials Park, Ohio: ASM International, 2002. ISBN 9780871707048.

Ashby, M. F.; Shercliff, Hugh; Cebon, David. Materials : engineering, science, processing and design. 3rd ed. Oxford : Butterworth-Heinemann ; Amsterdam [etc.]: Elsevier, 2014. ISBN 9780080977737.

Kienzler, Reinhold; Herrmann, George. Mechanics in material space : with applications to defect and fracture mechanics. Berlin: Springer, 2000. ISBN 3540669655.

Others resources:

Hyperlink

Journal of Nondestructive Testing (Ofereix articles en línia)

http://www.ndt.net/v03n12.htm

ASNT (American Society for Nondestructive Testing)

http://www.asnt.org/

Engineering Failure Analysis

http://www.sciencedirect.com/science/journal/13506307