Course guide
330122 - EMA - Materials Engineering

Last modified: 10/05/2023

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Soler Conde, Marc Antoni

Others: Soler Conde, Marc Antoni

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Knowledge of the mechanical behavior in service of the materials.
2. Know the basic processes of forming different types of engineering materials.
3. Select the most suitable material for basically structural applications.

Transversal:
4. 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.
6. 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.

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

Type	Hours	Percentage
Hours small group	30,0	20.00
Self study	90,0	60.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

(ENG) 1. Els materials d'enginyeria i les seves propietats

Description:
Materials properties in engineering.

Full-or-part-time: 2h
Theory classes: 1h
Self study : 1h

Stress -strain in materials

Description:
content english

Full-or-part-time: 4h
Theory classes: 2h
Self study : 2h

title eng3. Tensile test and properties.

Description:
Fundamentals of Young's modulus
Practical cases of design based on young's modulus
Yield stress
Dislocations and sliding

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

4. Fracture

Description:
Brittle fracture
Mecanisms of fracture
fracture probability in brittle materials

Full-or-part-time: 6h
Theory classes: 2h
Self study : 4h

5.Fatigue

Description:
Fatigue failure.
Desing based on fatigue
Examples

Full-or-part-time: 8h
Theory classes: 3h
Self study : 5h

6. Creep

Description:
Kinetic theory of diffusion.
Creep mechanisms and resistant materials to hot creep.
A turbine blade: a practical case of creep-limited design at high temperature.

Full-or-part-time: 6h
Theory classes: 2h
Self study : 4h

7. Metallic materials

Description:
Ferrous alloys
*Steels
*Cast irons
Non ferrous alloys

Full-or-part-time: 7h
Theory classes: 4h
Self study : 3h

8. non metallic materials

Description:
Polymers
Ceramics
Composites

Full-or-part-time: 4h
Theory classes: 2h
Self study : 2h

9. Cold formig

Description:
Rolling
Deep drawing
Streching

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

10. Hot formig

Description:
Forging
Stamping
Rolling
Extrusion

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

11.Materials selection

Description:
Material selection criteria
Objective function
Property maps

Full-or-part-time: 4h
Theory classes: 4h

ACTIVITIES

A.1. FEM exercices

Full-or-part-time: 30h
Theory classes: 16h
Laboratory classes: 14h

A.2.Homeworks

Full-or-part-time: 12h
Laboratory classes: 4h
Self study: 8h

A.3 Materials Selection

Description:
Probleme resolution on materials selection.

Full-or-part-time: 7h
Laboratory classes: 4h
Self study: 3h

A.4. Test. FEM

Description:
Finite element modeling test

Full-or-part-time: 6h
Self study: 6h

A.5. Progres test 1

Full-or-part-time: 2h
Theory classes: 2h

Test

Full-or-part-time: 2h
Theory classes: 2h

GRADING SYSTEM

N=A1*0.1+A2*0.1+A4*0.21+A5*0.1+A6*0.49

BIBLIOGRAPHY

Basic:
- Ashby, M.F.; Jones, D. R. H. Materiales para ingeniería. Vol. 1, Introducción a las propiedades, las aplicaciones y el diseño [on line]. Barcelona: Reverté, 2008-2009 [Consultation: 27/05/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?docID=5635457. ISBN 9788429172553.
- Ashby, M.F.; Jones, D. R. H. Materiales para ingeniería. Vol. 2, Introducción a la microestructura, el procesamiento y el diseño [on line]. Madrid: Reverté, 2009 [Consultation: 13/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=7725. ISBN 9788429172560.

Complementary:
- DeGarmo, E. P.; Black, J. T. ; Kohser, R. A. Materials and proceses in manufacturing [on line]. 8th ed. New York: John Wiley & Sons, 1999 [Consultation: 25/11/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=12108. ISBN 047136679X.
- Miracle, D. B.; Donaldson, S. L., editors. ASM handbook. Vol. 21, Composites. Ohio: ASM International, 2001. ISBN 9780871707031.
- ASM International Handbook Comittee. Ceramics and glasses. Metal Park, Ohio: ASM International, 1991. ISBN 0871702827.
- Kobayashi, Shiro; Oh, Soo-Ik; Altan, Taylan. Metal forming and the finite-element method. New York: Oxford University Press, 1989. ISBN 0195044029.
- Dieter, George Ellwood. Mechanical metallurgy. SI Metric. New York: McGraw Hill Higher Education, 1988. ISBN 0071004068.
- Anglada, M. J., ed. Fractura de materiales [on line]. Barcelona: Edicions de la Universitat Politècnica de Catalunya, 2002 [Consultation: 12/11/2020]. Available on: http://hdl.handle.net/2099.3/36175. ISBN 8483015927.
- Hosford, W. F.; Caddell, R. M. Metal forming: mechanics and metallurgy. 4th ed. Cambridge: Cambridge University Press, 2011. ISBN 9781107004528.
- Mangonon, Pat L. Ciencia de materiales: selección y diseño. México: Prentice Hall, 2001. ISBN 9702600278.
- Gilbert, Marianne. Brydson's plastics materials [on line]. 8th ed. Amsterdam: Butterworth-Heinemann, 2017 [Consultation: 10/06/2022]. Available on:

https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780323358248/brydsons-plastics-materials. ISBN 9780323358248.

RESOURCES

Other resources:
- Commercial calculation program using the ABAQUS finite element method.
- Laboratory equipment.