Course guide
240EM131 - 240EM131 - Micromechanical Design, Nanomechanical and Coatings

Last modified: 02/06/2022

Unit in charge: Barcelona East School of Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Optional subject).

Academic year: 2022 **ECTS Credits:** 4.5 **Languages:** English

LECTURER

Coordinating lecturer: LUIS MIGUEL LLANES PITARCH

Others: Llanes Pitarch, Luis Miguel
Alcala Cabrelles, Jorge

PRIOR SKILLS

No one previous capacity

REQUIREMENTS

No prerequisite

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMCEM-03. (ENG) Aplicar mètodes innovadors en la resolució de problemes i aplicacions informàtiques adequades, pel disseny, simulació, optimització i control de processos de producció i transformació de materials
CEMCEM-07. (ENG) Dissenyar, calcular i modelar aspectes relacionats amb els materials per a components mecànics, estructures i equips

Transversal:
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

TEACHING METHODOLOGY

The course will be divided in four different modules. The teaching methodology for each module will be: Theoretical class and autonomous learning exercises will be done in each module. Different presentations (e.g. oral presentations, movies and conceptual maps) and small exercises will be presented and delivered as a part of the final mark.

LEARNING OBJECTIVES OF THE SUBJECT

The objective of this subject is that the student will acquire the introductory knowledge and skills over mechanical characterization, microstructure as well as the main deformation mechanisms induced under complex stress fields for bulk and coating systems.
At the end of the course the student should be able to correlate the microstructure/properties at the micro- and nanometric length scale.

STUDY LOAD

Type	Hours	Percentage
Hours small group	13,5	12.00
Self study	72,0	64.00
Hours large group	27,0	24.00

Total learning time: 112.5 h

CONTENTS

Module 1: Length scale issues and size effects on the mechanical response of materials: deformation, fracture and fatigue

Description:
Relation between microstructure and mechanical properties

Specific objectives:
Discussion and presentation of a scientific paper

Full-or-part-time: 27h
Theory classes: 9h
Self study : 18h

Module 2: Experimental techniques as applied to nanomechanics: nanoindentation, AFM and FIB

Description:
Basic principles of nanoindentation
Atomic force microscopy
Focused ion beam

Related activities:
Deliverable activities
Poster

Full-or-part-time: 27h
Theory classes: 9h
Self study : 18h

Modul 3: Micromechanical Description of Crystal Plasticity

Description:
Description of the main plastic deformation mechanisms

Related activities:
Presentation and discussion of a scientific paper

Full-or-part-time: 27h
Theory classes: 9h
Self study : 18h

Modul 4: MEMs and Coatings

Description:
Fracture and Fatigue of Materials for Microsystems
Surface Modification Technology / Thin Films
Tribomechanical Response of Hard Coatings

Related activities:
Conceptual map
Movie (scientific journal)

Full-or-part-time: 31h 30m
Theory classes: 9h
Self study : 22h 30m

GRADING SYSTEM

25% each module (25% module 1 + 25% module 2 + 25% module 3 + 25% module 4)

BIBLIOGRAPHY

Basic:
- Dieter, George E. Mechanical metallurgy. New York [etc.]: McGraw-Hill Book Company, cop. 1986. ISBN 0070168938.
- Fischer-Cripps, Anthony C. Nanoindentation [on line]. 3rd ed. New York, NY: Springer New York, 2011 [Consultation: 20/05/2020]. Available on: http://dx.doi.org/10.1007/978-1-4419-9872-9. ISBN 9781441998729.
- Hull, Derek; Bacon, D. J. Introduction to dislocations [on line]. 5th ed. Saint Louis, MO: A Butterworth-Heinemann Title, 2011 [Consultation: 20/05/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=680874. ISBN 9780080966731.