

Course guide

240EM135 - 240EM135 - Functional Materials

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:** Spanish

LECTURER

Coordinating lecturer: EMILIO JIMENEZ PIQUÉ

Others: Primer quadrimestre:
TERESA ANDREU ARBELLA - T10
JOSÉ MANUEL GARCÍA TORRES - T10
EMILIO JIMENEZ PIQUÉ - T10

PRIOR SKILLS

Basic knowledge of electrical, magnetic, thermal and optic properties of materials

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CEMCEM-02. (ENG) Dissenyar i desenvolupar productes, processos, sistemes i serveis, així com l'optimització d'altres ja desenvolupats, atenent a la selecció de materials per a aplicacions específiques

CEMCEM-04. (ENG) Realitzar estudis de caracterització, avaluació i certificació de materials segons les seves aplicacions

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

master class

LEARNING OBJECTIVES OF THE SUBJECT

The objective of this subject is to acquire fundamental knowledge about material technology in some functional applications (electrical, optical, magnetic and thermal).

STUDY LOAD

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



Total learning time: 112.5 h

CONTENTS

Ligth and Materials

Description:

Colorimetry
Causes of color in Materials
Color due to Electronic and Molecular Transitions
Color due to Band transitions
Dyes and pigments
Materials for laser. Laser types
Laser-materials interaction
Materials for Lighting: LEDs, fluorescence and incandescence

Full-or-part-time: 37h 30m

Theory classes: 13h 30m

Guided activities: 9h

Self study : 15h

Electrical and Magnetic Response

Description:

Materials for hard magnets
Materials for soft magnets
Materials for magnetic information storage
Thermocouples
Cooling by Peltier effect
Thermoelectric generators
Superconducting materials

Full-or-part-time: 37h 30m

Theory classes: 13h 30m

Guided activities: 9h

Self study : 15h

Further topics on functional materials

Description:

Manufacture of monocrystals
Thermal barrier coatings
Materials Acoustics
Materials for musical instruments

Full-or-part-time: 37h 30m

Theory classes: 13h 30m

Guided activities: 9h

Self study : 15h



GRADING SYSTEM

$$NF = 0.5EX + 0.2P + 0.2TF + 0.1NEC$$

NF= Course Grade

EX= End-term exam

P = Mid-term exam

TF = Presentation

NEC= Class grade

EXAMINATION RULES.

Calculator

BIBLIOGRAPHY

Basic:

- Jiles, David. Introduction to magnetism and magnetic materials. 3rd ed. Boca Raton: CRC Press, Taylor & Francis Group, [2016]. ISBN 9781482238877.
- Coey, J. M. D. Magnetism and magnetic materials. Cambridge: Cambridge University Press, 2010. ISBN 9780521816144 (HBK.).
- Nassau, Kurt. The Physics and chemistry of color : the fifteen causes of color. 2nd ed. New York [etc.]: Wiley Interscience, cop. 2001. ISBN 0471391069.
- Hecht, Jeff. Understanding lasers : an entry-level guide. Hoboken, NJ: John Wiley & Sons, cop. 2008. ISBN 9780470088906.

Complementary:

- Kittel, Charles. Introduction to solid state physics. 8th ed. John Wiley & Sons: New York [etc.], cop. 2005. ISBN 047141526X.