



## Course guide

### 240EM135 - 240EM135 - Functional Materials

Last modified: 14/06/2023

**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).

**Academic year:** 2023    **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
Hours large group	27,0	24.00
Hours small group	13,5	12.00
Self study	72,0	64.00

**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

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

NF= Course Grade

EX= End-term exam

P = Mid-term exam

TF = Presentation

NEC= Class grade

## EXAMINATION RULES.

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Calculator

## BIBLIOGRAPHY

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### 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.