Course guide
295763 - 295EM123 - Functional Materials

Last modified: 26/06/2025

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

Degree: MASTER'S DEGREE IN MATERIALS SCIENCE AND ADVANCED MATERIALS ENGINEERING (Syllabus 2019). (Optional subject).
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2021). (Optional subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: PABLO GUARDIA GIRÓS

Others: Primer quadrimestre:
PABLO GUARDIA GIRÓS - Grup: T1

PRIOR SKILLS

Basic knowledge of materials science, chemistry and electrical, magnetic and optic properties of materials.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMCEAM-03. (ENG) Realizar estudios de caracterización y evaluación de materiales según sus aplicaciones

TEACHING METHODOLOGY

Expository and participatory classes
Work of analysis of practical cases and recent scientific publications with oral presentation.

LEARNING OBJECTIVES OF THE SUBJECT

The objective of this subject is to acquire fundamental knowledge about functional materials and their applications as well as the skills to solve conceptual problems for the challenges of current and future technolgies within materials engineering field.

STUDY LOAD

Type	Hours	Percentage
Self study	108,0	72.00
Hours large group	28,0	18.67
Hours small group	14,0	9.33

Total learning time: 150 h

CONTENTS

INTRODUCTION TO FUNTIONAL MATERIALS

Description:
Definition. Classification of functional materials. Examples. Synthetic strategies. Applications.

Specific objectives:
To learn basic concepts about functional materials including classification, types of materials and different methodologies to fabricate them and finally know some applications.

Full-or-part-time: 21h
Practical classes: 5h
Guided activities: 1h
Self study : 15h

MATERIALS FOR ELECTRIC APPLICATIONS

Description:
Fundamentals. Electrical phenomena (piezoelectricity, ferroelectricity,…) and physical origin. Materials with electrical properties. Applications.

Specific objectives:
To learn basic concepts about electrical properties and phenomena, types of materials with electrical properties and study some applications.

Related activities:
Elaboration of a report and presentation about a tòpic provided by the teaching staff.

Full-or-part-time: 35h
Practical classes: 9h
Guided activities: 4h
Self study : 22h

MATERIALS FOR MAGNETIC APPLICATIONS

Description:
Fundamentals of magnetism and magnetic properties. Magnetic phenomena and physical origin. Materials with magnetic properties. Applications.

Specific objectives:
To learn basic concepts about magnetic properties and phenomena, types of materials with magnetic properties and study some applications.

Full-or-part-time: 31h
Practical classes: 8h
Guided activities: 1h
Self study : 22h

MATERIALS FOR OPTIC APPLICATIONS

Description:
Fundamentals of optics. Optical phenomena and physical properties. Materials with optical properties. Applications.

Specific objectives:
To learn basic concepts about optical properties and phenomena, types of materials with optical properties and study some applications.

Full-or-part-time: 25h
Practical classes: 6h
Guided activities: 1h
Self study : 18h

MATERIALS FOR ELECTROCHEMICAL APPLICATIONS

Description:
Fundamentals of electrochemistry. Examples and analysis of electrochemical devices. Materials for electrochemical applications. Applications.

Specific objectives:
To learn basic concepts about electrochemistry, study some electrochemical devices and the properties of the materials involved. Review some fields of application.

Related activities:
Case study: Analyze a paper about materials for electrochemical applications.

Full-or-part-time: 38h
Theory classes: 25h
Practical classes: 10h
Guided activities: 3h

GRADING SYSTEM

NF= 0.5FEX+0.2MEX+0.2TF+0.1CS
NF= Course Grade
FEX= Final-term exam
MEX = Mid-term exam
TF = Presentation
CS= Case study
If reevaluation is required, the mark of the final-term and mid-term exams will be substituted by the reevaluation exam mark.

EXAMINATION RULES.

The specific rules for conducting the tests will be suitably indicated in each of the tests to be performed.

BIBLIOGRAPHY

Basic:
- Nou llibre.
- Nou llibre.

RESOURCES

Other resources:
Support material for the lectures available at Atenea.