Course guide
295756 - 295EM111 - Structure and Properties of Metal Alloys

Last modified: 04/06/2026

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 ADVANCED MATERIALS ENGINEERING (Syllabus 2019). (Optional subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: JESICA CALVO MUÑOZ

Others: Primer quadrimestre:
JESICA CALVO MUÑOZ - Grup: T1
BLAS SORITA LLEDO - Grup: T1

PRIOR SKILLS

The student must be familiar with the concepts and terminology of physical metallurgy explained in subjects of fundamentals of materials science and engineering.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMCEAM-01. (ENG) Dissenyar i desenvolupar productes, processos i sistemes, això com l'optimització d'altres ja desenvolupats, atenent a la selecció de materials per aplicacions específiques.

TEACHING METHODOLOGY

The subject will be taught based on lectures, case studies and laboratory practices

LEARNING OBJECTIVES OF THE SUBJECT

The objective of the course is for the student to acquire a broad vision of metal alloys of industrial interest. Common ferrous and non-ferrous alloys will be described, establishing relationships between processing, microstructure, properties and applications. Also, thermodynamic models will be provided for the prediction of phase transformations in metals.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

Introduction

Description:
Clasificación de los metales y sus principales aleaciones. Descripción de las principales características de las diferentes familias de metales

Specific objectives:
Classification of metals and their alloys. Description of the main characteristics of each family of metals

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

Ferrous alloys

Description:
Fe-C phase diagram and phase transformations in steels. TTT and CCT diagrams. Heat treatments. Construction steels. Sheet steels. Tool steels. Stainless steels. Cast iron.

Full-or-part-time: 42h
Theory classes: 10h
Laboratory classes: 5h
Guided activities: 2h
Self study : 25h

Copper and its alloys

Description:
Pure copper. Brasses, alloys and applications. Bronces, alloys and applications. Other copper alloys.

Full-or-part-time: 19h
Theory classes: 2h
Practical classes: 3h
Guided activities: 2h
Self study : 12h

Light alloys

Description:
Wrought aluminium alloys, heat-treatable and non-heat-treatable. Cast aluminium alloys. Alpha-titanium alloys and their applications. Alpha+beta titanium alloys and their applications. Beta titanium alloys and their applications. Main cast and wrought magnesium alloys. Applications of magnesium alloys.

Full-or-part-time: 25h
Practical classes: 3h
Laboratory classes: 2h
Guided activities: 2h
Self study : 18h

Phase transformations in metals

Description:
- Phase diagrams thermodynamics
- Interphases, nucleation and growth
- Martensitic transformation and microstructural characterization of low carbon steels
- Interfaces and grain growth

Full-or-part-time: 62h
Theory classes: 46h
Practical classes: 10h
Laboratory classes: 6h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

• NF = Final Grade
• EX = Final exam or 50% P1 + 50% P2 (If P1 and P2> 5)
P1 and P2 are partial exams 1 and 2
• NEC = Continuous Evaluation Note (activities, practices, presentations, ...)

EXAMINATION RULES.

The partial exams will be in the classroom, during the course schedule, one in the middle of the semester and another at the end.

If the student does not pass the partial exams, he/she must take the final exam at the time established for the final exam in January.

BIBLIOGRAPHY

Basic:
- Avner, Sidney H. Introducción a la metalurgia física. 2ª ed. México ; Madrid [etc.]: McGraw Hill, cop. 1979. ISBN 9686046011.
- Bhadeshia, H. K. D. H; Honeycombe, R. W. K. Steels : microstructure and properties. 3rd ed. Amsterdam [etc.]: Elsevier, cop. 2006. ISBN 9780750680844.
- Callister, William D. Introducción a la ciencia e ingeniería de los materiales [on line]. 2a ed. México, D.F.: Limusa Wiley, cop. 2009 [Consultation: 24/11/2021]. Available on: https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=2616389. ISBN 9786075000251.
- Polmear, I. J. Light alloys : from traditional alloys to nanocrystals. 4th ed. Amsterdam [etc.]: Elsevier, 2006. ISBN 0750663715.
- Porter, David A; Easterling, K. E; Sherif, Mohamed Y. Phase transformations in metals and alloys. 3rd ed. Boca Raton: CRC Press, cop. 2009. ISBN 1420062107.