Course guide
295704 - TEMA - Materials Technology

Last modified: 03/03/2026

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

Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).

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

LECTURER

Coordinating lecturer: MIGUEL MORALES COMAS

Others: Segon quadrimestre:
JAVIER GÓMEZ MONTERDE - Grup: M11, Grup: M12
NOEL LEÓN ALBITER - Grup: M11, Grup: M12
MIGUEL MORALES COMAS - Grup: M11, Grup: M12
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BLAS SORITA LLEDO - Grup: M11, Grup: M12

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

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STUDY LOAD

Type	Hours	Percentage
Hours large group	50,0	33.33
Self study	90,0	60.00
Hours small group	10,0	6.67

Total learning time: 150 h

CONTENTS

Introduction

Description:
In the introduction to the course, the classification of the main forming processes will be explained by material families. This classification will be related to the topics that will be developed throughout the course.

Specific objectives:
The aim is to establish a classification of the processes on which the course contents will be developed throughout the academic year.

Full-or-part-time: 2h 48m
Theory classes: 1h
Self study : 1h 48m

Casting

Description:
Study of metal casting processes, including solidification phenomena, microstructure formation, and the appearance of characteristic defects. The main industrial technologies are presented, such as sand casting, permanent mold casting, die casting, and centrifugal casting.

Specific objectives:
• To understand solidification mechanisms and their influence on microstructure.
• To identify typical casting defects and strategies for their control.
• To select the most suitable casting process according to the material and application.

Related activities:
Laboratory practice

Full-or-part-time: 6h 12m
Theory classes: 1h 30m
Laboratory classes: 2h
Self study : 2h 42m

Plastic deformation forming

Description:
Introduction to the fundamentals of plastic deformation forming under cold and hot conditions. Deformation mechanisms, the role of temperature and strain rate, and their influence on microstructural evolution and mechanical properties are analyzed.

Specific objectives:
• To understand the basic mechanisms of plastic deformation in metals.
• To analyze the influence of temperature and strain rate.
• To relate plastic deformation to the final properties of the part.

Related activities:
Laboratory practice

Full-or-part-time: 7h 36m
Theory classes: 2h
Practical classes: 2h
Self study : 3h 36m

Metals rolling

Description:
Study of hot and cold rolling processes, analyzing process parameters, involved forces, dimensional control, and the effects on microstructure and properties of the final product.

Specific objectives:
• To describe the operation and variants of the rolling process.
• To relate process parameters to quality and mechanical properties.

Full-or-part-time: 5h 36m
Theory classes: 2h
Self study : 3h 36m

Forging

Description:
Analysis of open-die and closed-die forging processes, considering the distribution of deformations and stresses and the influence of the process on the material flow lines.

Specific objectives:
• To understand the types of forging and their applications.
• To analyze the structural advantages of forged components.

Full-or-part-time: 5h 36m
Theory classes: 2h
Self study : 3h 36m

Sheet metal forming and hydroforming

Description:
Introduction to sheet metal forming processes: cutting, bending, deep drawing, and hydroforming.

Specific objectives:
• To understand the main sheet metal forming processes.
• To analyze formability limits.

Full-or-part-time: 5h 36m
Theory classes: 2h
Self study : 3h 36m

Metals extrusion

Description:
Study of direct and indirect extrusion processes, the materials used, and the achievable geometries.

Specific objectives:
• To understand the fundamental principles of the extrusion process.
• To analyze the influence of tooling design.

Full-or-part-time: 5h 36m
Theory classes: 2h
Self study : 3h 36m

Theory of plasticity

Description:
Introduction to the fundamental concepts of plasticity theory applied to metals.

Specific objectives:
• To understand yield and hardening criteria.
• To apply plasticity theory to forming processes.

Full-or-part-time: 2h 48m
Theory classes: 1h
Self study : 1h 48m

Machining, cutting, and welding

Description:
Study of material removal processes and the main welding processes.

Specific objectives:
• To understand the fundamentals of machining and cutting.
• To analyze the metallurgical effects of welding.

Full-or-part-time: 5h 36m
Theory classes: 2h
Self study : 3h 36m

Additive manufacturing of metals

Description:
Introduction to metal additive manufacturing technologies.

Specific objectives:
• To understand the main additive manufacturing processes.
• To compare them with conventional processes.

Full-or-part-time: 2h 48m
Theory classes: 1h
Practical classes: 1h 48m

Preparation and conditioning of ceramic powders

Description:
This topic addresses the methods used to obtain ceramic powders suitable for forming and sintering processes. Chemical techniques (precipitation, sol–gel, coprecipitation) and physical techniques (milling, spray drying) for powder synthesis are studied, as well as conditioning methods to optimize particle size distribution, dispersion, and flowability.

Specific objectives:
• To become familiar with the main chemical and physical methods for preparing ceramic powders.
• To understand the importance of particle size, morphology, and distribution in powder behavior.
• To apply conditioning techniques to improve rheology, densification, and powder uniformity.

Related activities:
Laboratory practices

Full-or-part-time: 11h 12m
Theory classes: 4h
Self study : 7h 12m

Ceramic forming processes

Description:
The different ceramic forming methods are studied, ranging from powder compaction to molding and plastic forming processes. The rheology of ceramic suspensions, extrusion, injection molding, slip casting and tape casting, and finishing processes are analyzed, including advanced techniques such as rapid prototyping and green machining.

Specific objectives:
• To understand the rheology of suspensions and its influence on forming processes.
• To learn about and compare forming techniques: dry pressing, isostatic pressing, extrusion, and injection molding.
• To apply appropriate molding and finishing processes according to the type of ceramic and final product.
• To explore modern rapid prototyping and layer deposition techniques.

Related activities:
Laboratory practice

Full-or-part-time: 20h 12m
Theory classes: 6h 30m
Practical classes: 2h
Self study : 11h 42m

Sintering of ceramics

Description:
The different ceramic forming methods are studied, ranging from powder compaction to molding and plastic forming processes. The rheology of ceramic suspensions, extrusion, injection molding, slip casting and tape casting, and finishing processes are analyzed, including advanced techniques such as rapid prototyping and green machining.

Specific objectives:
• To become familiar with the main chemical and physical methods for preparing ceramic powders.
• To understand the importance of particle size, morphology, and distribution in powder behavior.
• To apply conditioning techniques to improve rheology, densification, and powder uniformity.

Related activities:
Laboratory practice

Full-or-part-time: 11h 12m
Theory classes: 4h
Self study : 7h 12m

Processing of glasses, glass-Ceramics, frits, and glazes

Description:
The different types of glasses and their processing methods are explored, including flat glass, float glass, blown glass, tempered and laminated glass. The fabrication and processing of glass-ceramics, frits, and glazes are also studied, as well as the production of glass foams.

Specific objectives:
• To become familiar with glass manufacturing and forming techniques and their associated properties.
• To understand the processing of glass-ceramics and their transformation from frits.
• To apply glazing and surface finishing techniques for ceramic and glass materials.
• To analyze the final properties and applications of glasses and glass-ceramics in different sectors.

Full-or-part-time: 5h 36m
Theory classes: 2h
Self study : 3h 36m

Polymer extrusion

Description:
The principles of the process, polymer behavior during continuous flow, extrusion parameters, die and screw design, common defects, and industrial applications are studied.

Specific objectives:
• Analyze the physical and technological principles of polymer extrusion.
• Relate polymer properties to their behavior during the process.
• Identify extrusion parameters that affect the quality and final properties of parts.
• Understand the equipment components and the most common defects, as well as prevention strategies.

Full-or-part-time: 25h 48m
Theory classes: 8h 30m
Laboratory classes: 2h
Self study : 15h 18m

Polymer injection molding

Description:
The principles of the process, polymer behavior, injection parameters, mold design, common defects, and industrial applications are studied.

Specific objectives:
• Analyze the physical and technological principles of polymer injection molding.
• Relate polymer properties to their behavior during the process.
• Identify injection parameters that affect the quality and final properties of parts.
• Understand the equipment components and the most common defects, as well as prevention strategies.

Full-or-part-time: 25h 48m
Theory classes: 8h 30m
Practical classes: 2h
Self study : 15h 18m

GRADING SYSTEM