# Course guide
# 295704 - TEMA - Materials Technology

**Last modified:** 04/06/2026

**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:** 2026 **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
ORLANDO ONOFRE SANTANA PEREZ - Grup: M11, Grup: M12
BLAS SORITA LLEDO - Grup: M11, Grup: M12

## TEACHING METHODOLOGY

## LEARNING OBJECTIVES OF THE SUBJECT

.

## 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

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**.