

# Course guide 295584 - 295PB013 - Nanotechnology

**Last modified:** 02/10/2025

Unit in charge: Barcelona East School of Engineering

**Teaching unit:** 713 - EQ - Department of Chemical Engineering.

Degree: MASTER'S DEGREE IN POLYMERS AND BIOPLASTICS (Syllabus 2024). (Compulsory subject).

Academic year: 2025 ECTS Credits: 3.0 Languages: Catalan, Spanish, English

#### **LECTURER**

Coordinating lecturer: CARLOS ENRIQUE ALEMAN LLANSO

**Others:** Primer quadrimestre:

CARLOS ENRIQUE ALEMAN LLANSO - Grup: T1 CINDY LUISA ESCALONA GONZÁLEZ - Grup: T1

JORDI SANS MILÀ - Grup: T1

### **PRIOR SKILLS**

Nanotechnology

### **LEARNING RESULTS**

### **Knowledges:**

- K3. Identify the fundamentals of the processes of synthesis, manufacture, modification, use, recycling and degradation of polymers and biopolymers.
- K1. Identify the molecular chemical structure of polymers and biopolymers.
- K5. Relate the structure and properties of polymers and biopolymers in order to predict their behaviour and to obtain materials with new functionalities.
- K2. Identify the physical principles that govern the behaviour of polymers and underlie many of the techniques used in polymer analysis.

#### Skills:

- S5. Select polymers and biopolymers according to their properties and intended use.
- S6. Design and optimise polymeric materials for specific applications.

#### **Competences:**

- C3. Apply acquired knowledge and problem-solving skills both in discipline-specific environments and in new or unfamiliar environments in broader (or multidisciplinary) contexts related to the field of study.
- C2. Apply appropriate methods of analysis, production and management in the field of polymers and biopolymers.
- C4. Make effective use of information resources, managing the acquisition, structuring, analysis and visualisation of data and information within the field of specialisation and critically evaluating the results of this process.

#### **TEACHING METHODOLOGY**

Classes and presentation of works.

### **LEARNING OBJECTIVES OF THE SUBJECT**

Learn basic knowledge related to the use of polymers and biopolymers in nanotechnology. Learn the concepts that relate the structure and properties of polymeric nanostructured materials.

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# **STUDY LOAD**

Туре	Hours	Percentage
Hours large group	27,0	36.00
Self study	48,0	64.00

Total learning time: 75 h

# **CONTENTS**

### Introduction

### **Description:**

Nanometric couplings. Specific interactions of coupling. Simple nanometric structures of molecules: geometric relations. Hierarchical structure. Methods of characterization of the nanostructure.

# Specific objectives:

Acquire basic knowledge and theoretical foundations about nanotechnology.

**Full-or-part-time:** 3h Theory classes: 3h

#### **Polymeric nanoparticles**

#### **Description:**

 $Types\ of\ nanoparticles,\ synthesis\ of\ nanoparticles,\ characterization\ of\ nanoparticles,\ applications\ of\ nanoparticles.$ 

**Full-or-part-time:** 11h Theory classes: 11h

# **Polymeric nanomembranes**

#### Description:

The materials for the manufacture of ultra-fine membranes. Preparation of ultra-fine membranes. Giant nanomembranes The functionalization of ultra-fine membranes in Electronics and Biomedicine.

### Specific objectives:

**Full-or-part-time:** 11h Theory classes: 11h

### **Polymeric nanofibers**

### **Description:**

Polymeric materials for the manufacture of nanofibres. Preparation of nanofibres. The functionalization of nanofibres. Applications of nanofibres.

**Full-or-part-time:** 11h Theory classes: 11h

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#### **Polymeric nanogels**

### **Description:**

Hydrogels and nanogels. Properties and types. Applications of nanogels.

**Full-or-part-time:** 11h Theory classes: 11h

## Nanocomposites based on nanotubes, nanofibres, nanoparticles and nanosheets

#### **Description:**

Nanocomposites NTC-polymer. Manufacture, structure and properties of NTC. Optimization of dispersions. Natural and synthetic nanofibres. Dispersion strategies: superficial modifications and grafts. Silica and gold nanoparticles. Magnetic nanoparticles. Silicate-polymer nanocomposites. Laminated silicates. Interface effects: nanostructuring. Organic silicate modification. Methods for preparing nanocomposites. Modification of properties. Nanocomposite double hydroxides laminars-polymer. Graphene Nanocomposites.

**Full-or-part-time:** 11h Theory classes: 11h

### **GRADING SYSTEM**

 $NC = (NP1 + NP2 + 2 \cdot E)/6$ 

where NC is the course mark, NP1-NP2 are the notes of the for parts in which the subject is divided and E is the mark of the exam.

# **EXAMINATION RULES.**

Works and presentations drawn up by teams of two-three students depending on the number of students enrolled.

The written exam will be held individually at the end of the semester. It has a minimum of 70% attendance at the classes, in order to be able to reflect the preparation of the different Works assigned to teams.

# **RESOURCES**

# Other resources:

Supplied by the teaching staff.

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