# Course guide
# 295582 - 295PB012 - Experimentation and Instrumentation

**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:** English

## LECTURER

**Coordinating lecturer:** LUIS JAVIER DEL VALLE MENDOZA - NURIA SAPERAS PLANA

**Others:** Primer quadrimestre:
LUIS JAVIER DEL VALLE MENDOZA - Grup: T1
NURIA SAPERAS PLANA - Grup: T1

## PRIOR SKILLS

This is a practical course; therefore, laboratory experience would be desirable.
It is also advisable to be acquainted with the use of Excel and basic statistical analysis.

## 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.
K2. Identify the physical principles that govern the behaviour of polymers and underlie many of the techniques used in polymer analysis.
K4. Apply the necessary criteria for the analysis and characterisation of macromolecular materials and for the selection of technologies required for their production and processing.

**Skills:**
S3. Interpret the results of polymer analysis and characterisation techniques.
S1. Work rigorously and safely in a polymer laboratory.
S2. Make appropriate use of a range of polymer analysis and characterisation techniques.
S4. Make appropriate use of different techniques for polymerisation and transformation of polymeric materials.

**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

Laboratory sessions performed in small groups.

## LEARNING OBJECTIVES OF THE SUBJECT

To provide the students with the knowledge and skills required to perform the synthesis and characterization of several types of polymers and composites and their characterization through different techniques.

## STUDY LOAD

| Type | Hours | Percentage |
|---|---|---|
| Self study | 51,0 | 68.00 |
| Hours small group | 24,0 | 32.00 |

**Total learning time:** 75 h

## CONTENTS

### Polymerization processes

**Description:**
This block includes a short introductory theory session and the following laboratory sessions:
P1 - Bulk polymerization: Poly(methyl methacrylate) (PMMA)
P2 - Interfacial polymerization: Nylon-6,10 (polyamide)
P3 - Solution polymerization: linear and cross-linked Polyacrylamide (PAM)
Electrophoretic analysis of natural polyamides (proteins) using cross-linked PAM.
P4 - Composites: preparation of a laminate of glass fiber reinforced polyester resin
Bioplastics from starch

**Specific objectives:**
To become acquainted with the use of some of the main polymerization techniques.

**Full-or-part-time:** 37h 30m
Theory classes: 1h 15m
Laboratory classes: 10h
Self study : 26h 15m

### Polymer characterization

**Description:**
This block includes a short introductory theory session and the following laboratory sessions:
C1 - Physical properties of a plastic material
C2 - Staining of a plastic material
C3 - Water absorption in hydrogels
Determination of the hydrophobicity/hydrophilicity of a polymeric material surface: Contact angle measurement
C4 - Analysis of plastic materials by infrared spectroscopy (FTIR)

**Specific objectives:**
To become acquainted with the use of some of the main polymer characterization techniques.

**Full-or-part-time:** 37h 30m
Theory classes: 1h 15m
Laboratory classes: 10h
Self study : 26h 15m

## GRADING SYSTEM

8 lab reports (12.5 % each)

## EXAMINATION RULES.

All laboratory practices are mandatory.
A report must be submitted for each of the laboratory sessions.
The final mark will correspond to the average of the mark of the 8 reports.

## BIBLIOGRAPHY

**Basic:**

- Braun, Dietrich. Polymer synthesis : theory and practice : fundamentals, methods, experiments. 5th ed. Berlin [etc.]: Springer, cop. 2013. ISBN 9783642289798.
- Collins, Edward A.; Bares, Jan; Billmeyer, Fred W. Experiments in polymer science. New York: Wiley-Interscience, cop. 1973. ISBN 0471165840.
- Hundiwale, D. G. Experiments in polymer science. New Delhi: New Age International, cop. 2009. ISBN 9788122423884.
- Sandler, Stanley R. Polymer synthesis and characterization : a laboratory manual [on line]. San Diego: Academic Press, 1998 [Consultation: 13/09/2024]. Available on: https://discovery.upc.edu/permalink/34CSUC_UPC/rdgucl/alma991001891599706711. ISBN 9780126182408.

## RESOURCES

**Other resources:**

Classroom material available at ATENEA