Universidad del País Vasco
Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Fourth year

COURSE

26120 - Industrial Polymerisation Processes **Credits, ECTS:** 6

COURSE DESCRIPTION

The main objective of the subject is that the student acquires knowledge about the polymerization reaction engineering, so that he/she can understand the production processes of the main commercial polymer families (polyolefins, PVC, styrene/acrylic copolymers, vinyl/acrylic copolymers or PET amongst others). For that purpose, polymerization kinetics, polymerization techniques, different kinds of processes and reactors used and the properties of the polymers and copolymers produced will be discussed.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The following cross skills will be developed:
M03CM17 - Demonstrate observation, analysis and synthesis skills with a capacity for criticism and self-criticism.
M03CM18 - Demonstrate a capacity for learning and for autonomous work for professional development.
M03CM19 - Be able to manage, organise and plan chemical processes, applying criteria of quality and environmental conservation.
M03CM20 - Relate chemistry with other disciplines and understand its impact on the industrial and technological society and the importance of the industrial chemical sector.
Together with the following specific skills:
M03CM02 - Possess basic knowledge of the most common industrial technologies in the production of polymers and the engineering of the reactors used in the production process.
M03CM04 - Possess adequate knowledge of the large families of industrial polymers, their production, properties and most typical applications.
M03CM12 - Possess knowledge of the network tools and services that enable searches for information in the field of chemistry and similar fields.
M03CM13 - Transmit phenomena and processes related to chemistry and similar fields in verbal presentations and/or written reports and in a comprehensible way in either of the two official languages of the Autonomous Community of the Basque Country or in English.
M03CM14 - Be able to use the information and knowledge gained from the module for training in existing or emerging fields related to chemistry.

Theoretical and Practical Contents

1.- Introduction to Polymerization Processes
2.- Ideal reactors. Chemical reactions engineering
3.- Coordination polymerization engineering
4.- Free radical (co)polymerization engineering in homogeneous systems
5.- Polymerization in dispersed phase. Suspension and emulsion polymerization
6.- Step-growth polymerization

TEACHING METHODS

Theoretical and practical concepts (exercises, assignments, presentations) will be developed in the on-site lectures. This part of the course will be evaluated by a single written exam and it will take 60% the final mark.
Computer simulations will be conducted to solve an assignment of a polymerization process. In this part of the course, the student will learn how to simulate polymerization processes using a commercial software package (Predici). In this activity, the student will have to seek for the necessary information in the literature, will have to develop a mathematical model for the process and solve it numerically using the simulation package. Finally, he/she will write a report and present it to classmates.
Lab training is also a part of the course. The student will learn how to run a polymerization reaction, and he/she will learn how to measure the kinetics and the microstructure of the polymer under investigation.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	40		10	10					
Horas de Actividad No Presencial del Alumno/a	60		20	10					

Legend: M: Lecture-based | S: Seminar | GA: Applied classroom-based groups | GL: Applied laboratory-based groups | GO: Applied computer-based groups | GCL: Applied clinical-based groups | TA: Workshop | TI: Industrial workshop | GCA: Applied fieldwork groups

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 60%
- Exercises, cases or problem sets 10%
- Computer simulation assignment: Written report and oral presentation 30%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

As explained in the table above, the written exam will be 60% of the final mark. The simulation report and presentation will be 30% of the mark, and the experimental laboratory work will be 10% of the mark.
As the written exam is 60% of the mark, in order to get a "Non-presented", the student will have to inform the lecturer one month in advance of the exam.

If the student choses the Single exam method to pass the course he/she will have to warn the lecturer no later than 9 weeks after the official launch of the semester his/her decision (according to the rules stablished in article 8 of the chapter 2 of the student evaluation rules of the UPV/EHU). The lecturer will inform the student about the way in which he/she will evaluated in the single exam, but the exam will cover all the aspects cover in the 3 parts of the continuous evaluation. The Single exam request will be in place for the 2 calls of the course.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the extraordinary evaluation (June-July) only the written exam corresponding to the 60% of the mark will be offered. The marks achieved in the computer simulation assignement and the lab training will be maintained. The overall mark of the course will be calculated as in the ordinary call.
As the written exam is 60% of the mark, in order to get a "Non-presented", the student will have to inform the lecturer one month in advance of the exam.

MANDATORY MATERIALS

Required materials will be given at the beginning of the course.

BIBLIOGRAPHY

Basic bibliography

1.- "Polymer Reaction Engineering", J.M. Asua Ed. Blackwell 2007.
2. "Handbook of Polymer Reaction Engineering", T. Meyer, J. Keurentjes, Willey, 2005.
3.-"Principles of Polymerization Engineering". J. A. Biesenberger eta D. H. Sebastian. J. Wiley. N.Y., 1983

Detailed bibliography

1.-"Reaction Engineering of Step Growth Polymerization".S. K. Gupta y A. Kumar. Plenum Chem. Eng. Series. Plenum Press, N.Y., 1987.
2.-"Emulsion Polymerization". I. Piirma. Academic Press. N.Y., 1982.
3.-"Emultsio-Polimerizaziorako erreaktoreen Injineritza".J. Asúa, M. J. Barandiaran. Zubize, 1985.
4.-"Principles of Polymerization". Third Edition. George Odian. J. Wiley. N.Y., 1991
5.- "Emulsion Polymerization and Emulsion Polymers" P.A. Lowell eta M.S. El-Aasser, Wiley 1997
6.-"Emulsion Polymerization: A Mechanistic Approach" B. Gilbert, Academic Press 1995
7.- " Polymeric dispersions: Principles and applications" J.M. Asua, Kluwer 1997
8.- "Polymerization Process Modelling" N.A. Dotson, R.G. Galvan, R.l. Lawrence, M. Tirrell, VCH (1996).
9.- "Les Latex Synthetiques:Elaborations, propietes, aplications", C. Pichot, J.C. Bernard, Lavoisier, 2006

Journals

Macromolecules
Industrial and Engineering Chemistry Research
Polymer

Web sites of interest

Macrogalleria: http://pslc.ws/spanish/index.htm
Working Party on Polymer Reaction Engineering: http://www.wppre.com/

OBSERVATIONS

Nothing