



**COURSE GUIDE** 2024/25

**Faculty** 310 - Faculty of Science and Technology

**Cycle** .

**Degree** INQUI15b - Master in Chemical Engineering

**Year** .

**COURSE**

505171 - Refinery and petrochemical technologies

**Credits, ECTS:** 3

**COURSE DESCRIPTION**

In this course we study the refinery processes that allow obtaining fuels and chemicals (raw materials of the petrochemical industry and lubricants) from crude oil. Special emphasis is placed on the state of the art of current technology and the challenges in the medium and long term, based on two fundamental aspects: the quality of the products obtained and the environmental challenges of each stage. The course includes the visit to an industrial site and laboratory experiments.

**COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT**

**COMPETENCIAS DE LA ASIGNATURA**

- Know the current state of the standard technologies in industrial facilities of petroleum refining and petrochemical industries, pointing out the tendencies of processing of raw materials.
- Manage bibliographic sources that allow access to scientific and technological advances, to international technology trends in the use raw materials and studding data offered by specialized enterprises in the sector
- Identify and select the best options among the technological proposals studied according to the context and the possibilities of each region

**RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA**

- After completing the course, students will be able to:
- Identify and describe the different existing units in the refinery and in the petrochemical industry, based on raw materials, products, technologies, operating conditions and catalysts.
  - Characterize the main properties of crude oil and/or derived products (especially fuels and lubricants).
  - Investigate, by means of searches in databases, and communicate orally and/or in written form the technological advances of the different units of the refinery and the petrochemical industry.
  - Write technical reports (with a deadline) on a catalytic process developed in research laboratories.

**Theoretical and Practical Contents**

1. Introduction: Socio-economic perspective of the oil supply and the petrochemical industry. Properties of crude oil. General scheme of a refinery
2. Fractionation of crude oil: atmospheric distillation unit. Vacuum unit. Future trends: Progressive distillation unit
3. Processes for improving gasoline properties: Catalytic reforming, Isomerization, Alkylation and Oligomerization
4. Thermal Conversion: Introduction. Coking. Visbreaking. Future trends
5. Fluidized Catalytic Cracking (FCC): Introduction. Feedstock. Products. Description of the process. Process variables. Reaction mechanism. Catalysts. Challenges
5. Hydroprocessing: Hydrocracking and Hydrotreatment
7. Petrochemical: Light olefins. Aromatics
8. Lubricants: Lubricants. Tribology

**METODOLOGIA (ACTIVIDADES FORMATIVAS)**

| Actividad Formativa                            | Hours | Porcentaje presencialidad |
|--|-------|---------------------------|
| Visit to industrial sites                      | 4     | 100 %                     |
| Groupwork                                      | 8     | 50 %                      |
| Expositive classes                             | 18    | 100 %                     |
| Handling experimental equipment and facilities | 20    | 20 %                      |
| Handling sources and resources                 | 25    | 0 %                       |

**TYPES OF TEACHING**

| Types of teaching                             | M  | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|----|---|----|----|----|-----|----|----|-----|
| Hours of face-to-face teaching                | 18 | 4 |    | 4  |    |     |    |    | 4   |
| Horas de Actividad No Presencial del Alumno/a | 25 | 8 |    | 8  |    |     |    |    | 4   |

**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 tools and percentages of final mark**



| Denominación        | Ponderación mínima | Ponderación máxima |
|---------------------|--------------------|--------------------|
| Written examination | 30 %               | 70 %               |
| Practical tasks     | 30 %               | 70 %               |

#### ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The ordinary call consists of the evaluation of two parts, weighted in the following way:

- Written exam, 30% of the grade. Minimum mark: 5
- Individual/group practical works, 70% of the grade

Portfolio: 20 %

Laboratory research report: 25 %

Informative poster of innovations in the refinery and petrochemical industry: 25 %

In case of renouncing the ordinary call, the assessment will be carried out in the following way:

- Written exam, 100% of the grade, containing additional questions to assess the knowledge evaluated in the Individual/group practical works.

If the health conditions prevent the realization of a face-to-face assessment, the planned evaluation tests will be carried out using the available telematic means (eGela, BBC)

#### EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The extraordinary exam consists of a written exam that accounts for 100% of the grade, containing additional questions to assess the knowledge evaluated in the Individual/group practical works.

If the health conditions prevent the realization of a face-to-face assessment, the planned evaluation tests will be carried out using the available telematic means (eGela, BBC)

#### MANDATORY MATERIALS

e-gela

#### BIBLIOGRAPHY

##### Basic bibliography

- Wauquier, J.P., El Refino del petróleo. Petróleo crudo, productos petrolíferos y esquemas de fabricación, Ed. Diaz de Santos, 2004
- Ramos Carpio, M. A., Refino del petróleo, gas natural y petroquímica; Ed. Fundación Fomento Innovación industrial, Madrid (1997).
- Hsu, C., Robinson, P.; "Handbook of Petroleum Technology". Springer. New York, 2017.
- Leprince, P., Petroleum Refining. 3. Conversion Processes. Ed. Technip, 2001
- Matar, S. Hatch, L. F., Chemistry of Petrochemical Processes, Elsevier, 2000
- Chauvel, A., Lefebvre, G., Petrochemical Processes. Technical and Economic Characteristics; Ed. Technip, Paris, 1989.

##### Detailed bibliography

- Meyers, R.A., Handbook of Petroleum Refining Processes, Ed. McGraw-Hill, 2003
- Parkash S., Refining Processes Handbook, Elsevier, 2003
- Speight, J.G., Petroleum Refining Processes (Chemical Industries), Ed. Marcel Dekker, 2002

##### Journals

Ind. Eng. Chem. Res., AIChE J., Energy and Fuels, Fuel, Fuel Proc. Technol., Chem. Eng. J., Energy Conv. Manage., Energy,...)

##### Web sites of interest

Petronor: <https://petronor.eus/es/>

UOP: <https://www.uop.com/>