

## SUBJECT TEACHING GUIDE

### G791 - Instrumental Analytical Techniques

#### Degree in Chemical Engineering First Degree in Chemical Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Chemical Engineering First Degree in Chemical Engineering			Type and Year	Optional. Year 4 Optional. Year 4
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Option A: Fundamental Chemical Engineering Optional Module				
Course unit title and code	G791 - Instrumental Analytical Techniques				
Number of ECTS credits allocated	6	Term	Semester based (2)		
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. DE QUIMICA E INGENIERIA DE PROCESOS Y RECURSOS.				
Name of lecturer	JOSEFA FERNANDEZ FERRERAS				
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Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 3. DESPACHO (S3014)				
Other lecturers	DAVID HERNANDEZ MANRIQUE MARINA GONZALEZ BARRIUSO MIGUEL GARCIA IGLESIAS				

### 3.1 LEARNING OUTCOMES

- The student must acquire the ability to select the equipment and analytical method for applications in chemical engineering.
- Ability to design an instrumental analytical technique.

#### 4. OBJECTIVES

The student must acquire knowledge of the foundation and management of the main instrumental techniques used in the chemical industry.

#### 6. SUBJECT PROGRAM

##### CONTENTS

1	<p>SPECTROSCOPIC METHODS. Electromagnetic radiation. Molecular Absorption Spectroscopy: Nuclear Magnetic Resonance Spectroscopy (NMR) <sup>1</sup>H and <sup>13</sup>C. Infrared Absorption Spectroscopy (IR) and Raman Spectroscopy. Ultraviolet- Visible Absorption Spectroscopy (UV) . Mass spectrometry (MS). Atomic spectroscopy: Atomic Absorption Spectroscopy (AA) Atomic Emission Spectroscopy (EA): Flame photometry, Plasma Spectrometry (ICP, MP-AES), X-Ray Fluorescence (XRF).</p> <p>X-RAY DIFFRACTION (XRD): Rationale and applications.</p> <p>PRACTICES: FTIR, UV-visible, XRF, knowledge in situ of XRD / Raman equipments,</p>
2	<p>CHROMATOGRAPHIC METHODS. Description. Classification. Columns. Retention time, selectivity. Detectors. Qualitative and quantitative analysis. Gas chromatography. Liquid chromatography. Chromatography and supercritical fluid extraction.</p> <p>THERMAL METHODS. Thermogravimetric methods. TG applications. Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC) applications. Thermal methods with Evolved Gas Analysis (EGA). TG-GC-MS. Other methods of thermal analysis.</p> <p>MICROSCOPY. Transmission Electron Microscopy (TEM). Scanning Electron Microscopy (SEM). Atomic Force Microscopy (AFM).</p> <p>PRACTICES: DSC, TG-MS, GC-MS, knowledge in situ of TEM / SEM / AFM equipments.</p>

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Laboratory practices in blocks 1 and 2	Work	No	Yes	40,00
Quiz 1 Block 1	Written exam	No	Yes	15,00
Quiz 2 Block 1	Written exam	No	Yes	15,00
Quiz 3 Block 2	Written exam	No	Yes	15,00
Quiz 4 Block 2	Written exam	No	Yes	15,00
TOTAL				100,00
Observations				
<p>A minimum average grade of four points is needed as an average of the four questionnaires that will be carried out , two for each thematic block, to be able to average with the practice block.</p> <p>Work related to laboratory practices or other activities , will be evaluated throughout the course and will account for 40% of the final grade.</p> <p>It is necessary to obtain an average of five points in the subject.</p>				
Observations for part-time students				
<p>The final exam for part-time students will be 60% in the final assessment of the subject, the remaining 40% being the result of the assessment of an individual work assigned during the course and an exam or report of laboratory practices.</p>				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
<p>Harold Hart, Leslie E. Craine, David J. Hart, Christopher M. Hadad, 2007. Química Orgánica. Ed. Mc Graw-Hill.</p> <p>Harold Hart, Leslie E. Craine, David J. Hart, Christopher M. Hadad, 2012. Organic Chemistry: A Short Course, 13th Edition, Ed. Mc Graw-Hill.</p>
<p>Douglas A. Skoog, F. James Holler, Stanley R. Crouch, 2018. Principios de Análisis Instrumental. Cengage Learning, 7ª Ed..</p> <p>Douglas A. Skoog, F. James Holler, Stanley R. Crouch, 2018. Principles of Instrumental Analysis, 7th ed. International Student Edition, Thomsom Brooks /Cole.</p>
<p>Lucas Hernández Hernández, Claudio González Pérez, 2002. Introducción al análisis instrumental, Ed. Ariel.</p>
<p>Francis Rouessac, Annick Rouessac, 2013. Chemical Analysis: Modern Instrumentation Methods and Techniques, 2nd Edition. Libro electrónico, Ed. Wiley.</p>