

SUBJECT TEACHING GUIDE

G791 - Instrumental Analytical Techniques

Degree in Chemical Engineering

Academic year 2025-2026

1. IDENTIFYING DATA					
Degree	Degree in Chemical Engineering			Type and Year	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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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.</p> <p>Molecular Absorption Spectroscopy: Nuclear Magnetic Resonance Spectroscopy (NMR) ¹H and ¹³C. Infrared Absorption Spectroscopy (IR) and Raman Spectroscopy. Ultraviolet- Visible Absorption Spectroscopy (UV) .</p> <p>Mass spectrometry (MS).</p> <p>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	30,00
Quiz 2 Block 2	Written exam	No	Yes	15,00
Quiz 3 Block 2	Written exam	No	Yes	15,00
TOTAL				100,00
Observations				
<p>A minimum weighted average grade of four points is needed of the three questionnaires that will be carried out , 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

Harold Hart, Leslie E. Craine, David J. Hart, Christopher M. Hadad, 2007. Química Orgánica. Ed. Mc Graw-Hill.
 Harold Hart, Leslie E. Craine, David J. Hart, Christopher M. Hadad, 2012. Organic Chemistry: A Short Course, 13th Edition, Ed. Mc Graw-Hill.

Douglas A. Skoog, F. James Holler, Stanley R. Crouch, 2018. Principios de Análisis Instrumental. Cengage Learning, 7ª Ed..
 Douglas A. Skoog, F. James Holler, Stanley R. Crouch, 2018. Principles of Instrumental Analysis, 7th ed. International Student Edition, Thomsom Brooks /Cole.

Lucas Hernández Hernández, Claudio González Pérez, 2002. Introducción al análisis instrumental, Ed. Ariel.

Francis Rouessac, Annick Rouessac, 2013. Chemical Analysis: Modern Instrumentation Methods and Techniques, 2nd Edition. Libro electrónico, Ed. Wiley.